THE GLASS INDUSTRY
VOLUME 27, NUMBER 5, MAY, 1946

FOSTER-FORBES MODERNIZES IT'S BATCH HANDLING

By FRED R. MOTSCH, Plant Superintendent
Foster-Forbes Glass Company

In early 1943 the labor situation in and around Marion, Indiana, as all over the nation, became quite acute with a definite promise of becoming much worse. This, with the steadily increasing demand for glass containers, convinced the officials of Foster-Forbes Glass Company that it was extremely necessary to replace our antiquated batch handling plants with a new system that could be operated with the minimum number of trustworthy workmen, or even by women, if necessary. Too much production time and tonnage was being lost because of mistakes made in the batch room by inexperienced and careless workers; equipment designed and installed fifteen or twenty years ago to handle material for thirty tons of glass a day for each of the two tanks required too many of the finest type of industrious, efficient and conscientious workmen to unload, weigh, and mix the batch for ninety tons of glass of a quality now required for the modern container.

After the decision was made that a batch plant was to be constructed, if proper priorities could be obtained, it was necessary to draw up broad plans and policies to govern future construction and expansion for years to come before the site of the new plant could be chosen, for it would be a sad monument to the present management to build such an expensive, permanent, and vital structure as a modern batch plant only to find in a few years that its location was the limiting factor in plant expansion, plant modernization, and economy in production. This was further complicated by the fact that the present buildings erected over a period of fifty years originally for the use of three separate companies (Foster-Forbes properties at Marion are composed of buildings built for Upland Flint Bottle Company, Standard Glass Company, and Koeppen Mould Company) be utilized to the greatest extent possible. Good plant layout is a requisite for efficient operation.

The best available glass plant engineers were consulted and asked to submit their designs for future development and expansion.

The location selected for the new batch plant is adjacent to the No. 2 Furnace building. Sufficient space was allowed so that a producer plant could be built close to any future tanks giving the shortest flues possible between the producers and tanks. Space was also allowed for a siding for unloading producer coal without interfering with the batch material unloading. This location set up these problems: (1) Moving batch from batch plant to No. 2 tank; (2) Moving batch to No. 1 tank a distance of one-fourth mile; (3) Returning cullet from No. 2 Packing Department and tank basement to cullet crusher then to storage bin; (4) Returning cullet from No. 1 Packing Department and tank basement to crusher and batch plant.

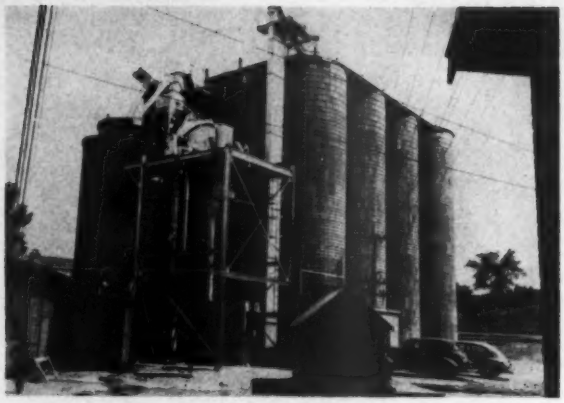
We believed the customary practice of mixing cullet with the rest of the batch materials was very desirable and worth the extra effort to return this to the batch plant, and it was also decided as a matter of policy to handle the mixed batch in individual cans.

The engineering and construction was further complicated by the necessity of installing the monorail system in the present buildings with as little interference with production as possible. The transition from batch made in the old batch plants to the new had to be done smoothly and without any cordy glass being made. This meant the new batch had to be exactly the same as the old.

All of the general plans, layouts of bins, and monorail equipment were done by the engineering department of the Foster-Forbes Glass Company, who also functioned as the general contractors for the job.

Soil tests and boring showed that piling was necessary to carry the concentrated load of the type of plant we desired to build. This load in certain areas reached as high as 24,000 pounds per square foot.

Raymond Concrete Pile Company of New York designed the piling arrangement and drove 380 steel tubes 14 to 26 feet in the subsoil which were filled with concrete. Each pile was driven to a point where it would

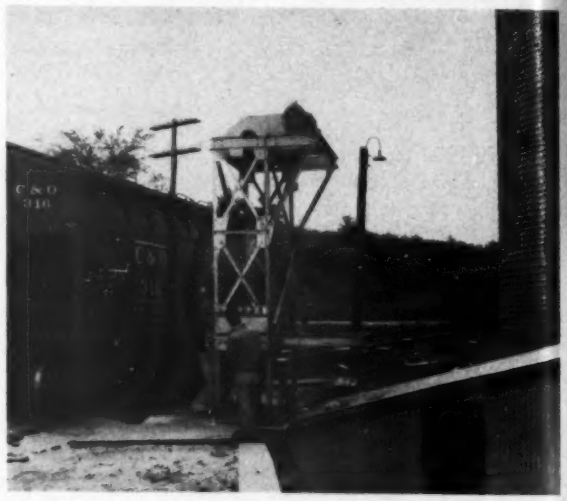


Installation of mixer. Bins completed, edge of concrete slab that forms the roof over silos can be seen. Also shown is the elevator for the weighed batch, the surge hopper with its two bin-dicators, the mixer in its tilted position, the flop gate that directs the batch either into the long universal-jointed chute or into the leg that empties the batch into the can on monorail which at this time had not been erected. The cullet hopper is seen at the lower end of the cullet elevator.

safely support a load of fifty tons. This company also designed the reinforcing steel layout for the slab that formed the cap over the piling and the floor of the batch plant. This slab, which was 60 by 100 feet and generally two feet thick, although in certain areas it was made over three feet thick, was built by the Bowman Construction Company, a local contractor.

The bins, or silos, for holding the material were manufactured and erected by the Neff and Fry Company of Camden, Ohio. Because of war restrictions and difficulty in getting experienced help it was decided to use what is called "concrete stave" type of construction. The staves, which are 2½ inches thick by 10 inches wide by 30 inches long, have a diagonally pointed shape that allows each stave to interlock with six adjoining staves. These are hydraulically pressed at 140 tons pressure from a carefully controlled aggregate and cement mixture following which they are properly aged and cured. This gives a superior concrete of almost 6000 pounds compressive strength. The staves are held together by galvanized steel reinforcing hoops on the outside of the bins. There are at least two or more hoops to each stave, the number depending upon the design of the bin and the pressure at that point. On some of the bins toward the bottom there is a hoop every four inches. The soda ash bin was made damp-proof by placing a mastic compound in the joints. All the rest of the bins were made waterproof by coating them on the inside with a neat cement, which sealed all the cracks and joints.

The batch plant is composed of nine separate silos, all but two are 60 feet high, three are 25 feet in diameter; one is 18 feet in diameter; three 16 feet in diameter; and two are 12 feet by 45 feet high. The size of each silo was determined largely by the desire to get at least twenty-one days supply of material in them, based on our present melting capacity. The feldspar bin contains



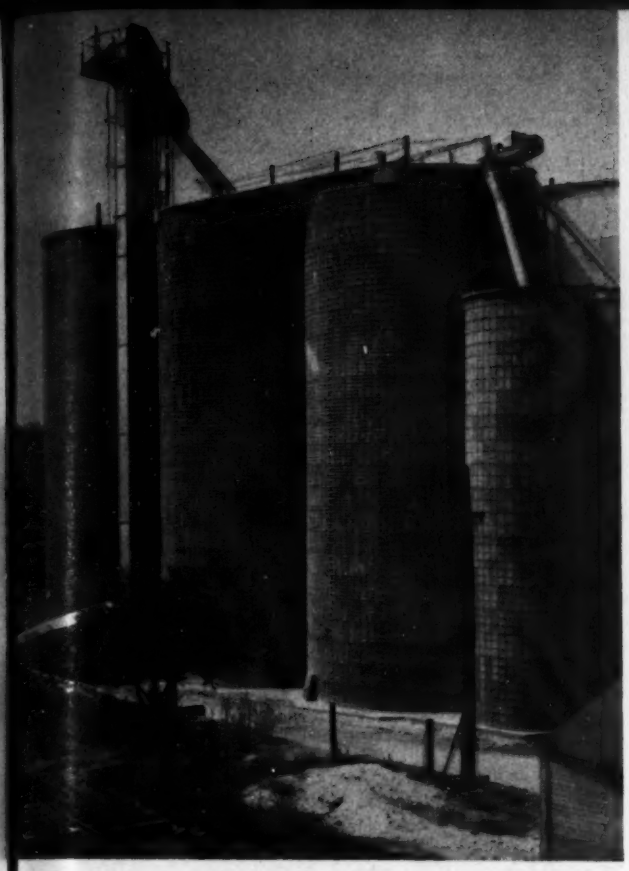
Car of material over track hopper. Steel framework supports power shovel mechanism. The sheave and hopper used for box cars is pulled back out of the way of the railroad cars. The interlocking switches and receptacles for keys can be seen behind workman. Note the inclined conveyor running from the track hopper to the elevator.

a forty day supply principally for three reasons: one, it comes the greatest distance; two, the general tendency in the industry is to use increasing quantities; three, it costs practically no more to build this size bin than a smaller one.

At the time the bin arrangement was laid out it had not been determined definitely whether the use of Monsanto slag was all for the best, but it was decided to include a bin and scales for its use. If it was not used for this material there would probably be another material soon that would be desirable for use in container glass. There was also the point that since this slag is composed basically of oxides that are also contained in the other batch materials (sand, limestone, feldspar) it is the one major material that can be removed abruptly without affecting the glass composition. This allows for considerable flexibility in case of severe damage to another scale or perhaps in changing from one major material to another.

These bins were placed in two rows—one on each side

Construction almost completed. Can of batch drawn by electric tractor is leaving batch plant on its way to No. 2 furnace. The control room with the batch plant's separate transformer bank on its flat deck roof houses the central control panel, the electric controls for all the motors used to operate the plant, the motor generator sets and a small air compressor to furnish air at 100 pounds pressure. Left to right—cullet, 16 ft. dia.; slag, 16 ft. dia.; feldspar, 16 ft. dia., and limestone silos, 18 ft. dia., all 60 ft. high.



Unloading elevator with hood housing the short swivel chute that directs the material into one of three chutes. To the right is head end of portable conveyor just used for the two small silos. Left to right are the two sand silos, each 25 feet in diameter; soda ash silo, 25 feet in diameter; salt cake silo and barytes silo, each 12 feet in diameter by 45 feet high.

of the gathering conveyor with a corridor, or space, of 10 feet wide by 60 feet high between the two rows of bins. There were several reasons for having this space—one, economy in construction; two, it made a better arrangement for the vibrating feeders and scale hoppers; three, it allowed considerable space to install more bins in case new, or additional, materials were required for glass making. It was kept in mind that it might be desirable some day to weigh and mix automatically two different glasses, such as amber and flint, and also if the past is any indication of what may happen in the future there will be other materials developed that are desirable for glass.

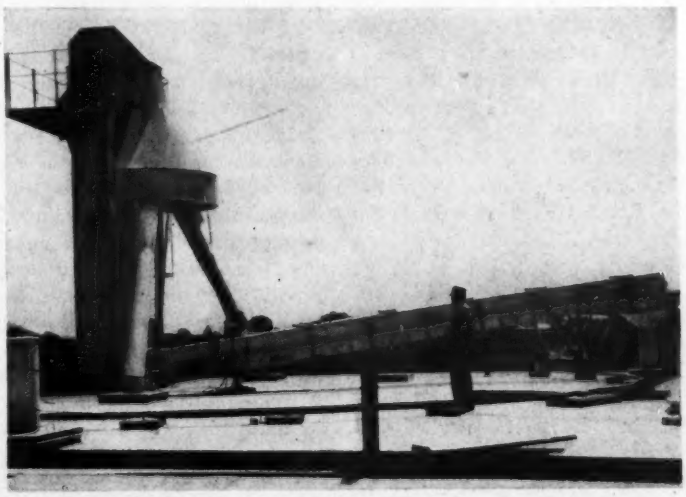
A separate brick building with glass brick panels and lined with glazed tile was built for housing the central control panel, the magnetic switches that control both the mixing cycle and the unloading equipment, the air compressor used to tilt the mixer and to operate the pneumatic valves, and the M G sets that operate the feeders. There is one large motor generator set for operating the feeders for the scale hoppers and there are two small M G sets, one for operating the feeder under the track hopper and one for operating the feeder that controls the flow of the cullet to the pulverizer.

The general layout, size, and capacity of the various silos were worked out between the engineers for the Jeffrey Manufacturing Company, who furnished the mechanical equipment, the engineers of Neff & Fry Company, and Foster-Forbes Glass Company.

Many bin layouts were made before the final design was selected that gave us optimum conditions not only from the bin construction standpoint and machinery layout but also by the exigency of our present and future factory layout.

The unloading equipment was designed to unload both hopper and box cars at a rate of 100 tons per hour. A 10-foot by 10-foot track hopper was installed under the railroad siding and the power shovel erected on a steel framework alongside the hopper where batch material is fed from the hopper onto a belt conveyor by means of a Jeffrey electric vibrating feeder. This feeder assures that there will be a uniform flow of material onto the conveyor belt so that it will never be overloaded. A 20-inch belt conveyor 30 feet long carries the material from the track hopper to the boot of a continuous bucket elevator 86 feet high between centers. At the discharge point of the elevator there is a swivel chute that can be moved to empty into any one of three stationary chutes. Two of these stationary chutes empty into the two sand silos. The third empties onto what is called the "pivoted" conveyor. This is a conveyor 33 feet long, pivoted at one end and at the head end it is mounted on two flange wheels that run on a curved rail. This conveyor can be swung around in an arc of approximately 120 degrees, reaching directly the limestone, feldspar, slag and soda ash bins. To reach the barytes and saltcake bins there is a portable conveyor 18 feet long on which the pivoted conveyor dumps the saltcake or barytes. The portable conveyor also may be used to run cullet into the cullet bin if its is ever desired to obtain cullet in railroad cars. The conveyors rest on a concrete slab that forms the roof over the silos.

On top of silos pivoted conveyor. All the electrical motors and wiring are weatherproofed as are the conveyors and elevators.



Much thought was given to the problem of minimizing, or eliminating the worst trouble encountered with a modern batch handling system, i. e., getting a carload of material in the wrong

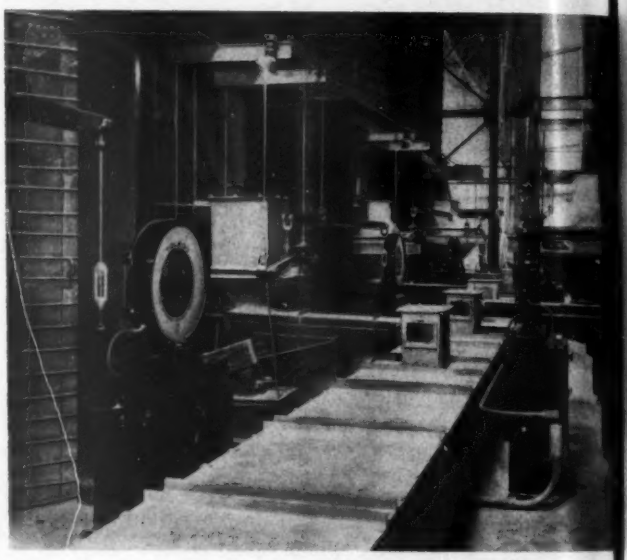
The tunnel into sand bin, Here is located the double electric vibrating feeder that conveys this material from the bin over to the weigh hopper. At the proper time in the batch cycle the lower feeder deposits it on the gathering belt.

bin, for once the material gets into the bin there is no means of detecting it until it shows up in the finished product at the end of the lehr. By that time all the tanks are filled with bad glass of the worst kind.

We devised and built an interlocking system for our unloading equipment. Our system is this—the head shipping supervisor, who receives the shipping notices for the cars of materials knows what cars are to be set by the switch engine each day. After the cars are set he takes out a key for each car and hangs it on the car in a designated place; for example—if he has three cars of sand, two cars of soda ash, and a car of limestone to be set, he takes out three sand keys, two soda ash keys and one limestone key, and places them on the cars according to the car numbers. The unloader after he sets the car of material over the track hopper, opens it to see what the car contains, removes the key from its place and puts it in what he believes is the correct lock, or receptacle. Since the key will only fit in one lock, if there has been a mistake either by the shipping supervisor or the unloader the key will not fit. The unloader then reports to the shipping supervisor that an error has been made; he and the shipping supervisor then determine where the mistake had occurred. In order for a mistake to go undetected at this point the shipping supervisor and the unloader would have to make the same mistake each in a separate method, which would be a very unusual coincidence. When a key is placed in the proper lock nothing will operate until the chute and all the conveyors are placed exactly in the right location to deliver the material to its bin. If the chute or conveyors are not located correctly for the material such as hoppers between cars of different materials, the unloader goes to the top of the silos and moves these into place. When the last one is located properly all the elevators and conveyors start automatically, allowing the unloader to check their operation and be sure that they are operating before he returns to the ground.

In order to take the material out of the bin close to the center it was necessary to build what are called tunnels in the bins since the bins themselves rest directly on the slab, which forms the floor of the batch plant.

In the top of each tunnel there is a rack and pinion valve of the proper size for the material to be handled. The material flows through this valve into an electric vibrating feeder that is controlled automatically by the weighing mechanism. This feeds into a scale weigh hopper. After the material is weighed out it is conveyed from this scale hopper onto the gathering conveyor by another vibrating feeder. There is a set of vibrating feeders, scale and hopper for limestone, feldspar, slag, cullet, soda ash, and sand. The barytes, saltcake, decolorizer and other minor ingredients, are weighed out by hand and placed in what is called a decolorizer unit. The decolorizer units were designed and built entirely by the Foster-Forbes Glass Company and hold enough material for eight batches, or rather four batches for each of the two types of glass. The decolorizer unit indexes automatically to feed the proper amount for each batch. If allowed to run empty the batch cycle can not complete itself until the decolorizer unit is filled and operated correctly. Although for several years no foreign cullet has been purchased the cullet silo and cullet weight mechanism were designed so that if it was ever desired to use foreign cullet the percentage of foreign to domestic cullet



Gathering conveyor and some of the automatic scales.

could be regulated so that there would always be the same amount of each in every batch. This system also permits the possibility of using one kind of cullet in one batch and another kind in the second batch. The weighed materials are carried by the gathering conveyor to the boot of a continuous bucket elevator 58 feet high. This dumps into a surge bin equipped with bin-dicators and as the batch is mixed at the proper point in the cycle the complete batch is allowed to flow into a T. L. Smith mixer. After the batch is mixed the mixer dumps it into a flop gate, which directs it either into a can on the monorail or into a can setting on the motor truck, depending upon which plant the batch is to be used.

The plant was designed with the thought that no regular batch man would be required. The truckdriver who hauls the batch to Plant 1 also operates the equipment

(*Continued on page* 256)

EXPECTATIONS FOR GLASS CONTAINER EXPORT MARKET*

Analyses of the glass-container export situation prior to the war, during the war and at the present time indicate what may be expected in the future of the exportation of glass containers. General deductions point to an increase in all foreign markets.

The Department of Commerce is again publishing data on the export markets for glass containers by countries of destination. We consider these figures of great importance not only to the exporters of glass containers but also to the domestic consumer who may find in the export trend a very significant indication of industrial activity abroad. This is particularly true in the case of the domestic pharmaceutical and cosmetic manufacturers and the bottlers of beverages, both alcoholic and non-alcoholic, as it is in these categories that the trend of industrial activity abroad is most pronounced.

One might expect that the war period resulted in a general slow-down of glass-container exports. Generally speaking, this is not true. On the contrary, war-time exports maintained a higher level than the 1937 to 1939 pre-war average. With the exception of the European markets, which were never a big factor in our glass-container exports, increases were registered all along the line. The bulk of the increase is to be found in the beverage-bottle category, including considerable expansion of bottling activity in foreign areas. This can be traced to the presence of large numbers of American and British military personnel who not only created a market for bottle beverages but also influenced to a large extent the consumption habits of the native population. Secondly, the war created a tremendous purchasing power in areas not directly affected by the war. This is particularly true of our neighbors below the border who bottled more beverages than ever before. Thirdly, United States restrictions during the war on manufacture of purely civilian items requiring glass containers acted as an incentive to foreign producers to manufacture more for export, much of which came back to the United States in the form of filled glass containers. Perhaps the most important consideration is the virtual elimination of European competition in the Central and South American markets. This is particularly true in the case of pharmaceutical and proprietary ware.

In view of the above, any potential measure of post-war markets for glass containers will depend largely upon the ability of foreign countries to maintain a high rate of purchasing power among their population, the size of United States military forces stationed at permanent bases in foreign countries, the extent to which war-damaged countries can re-establish production for domestic consumption and to what extent the United States will again absorb its pre-war foreign markets.

In terms of actual dollars, our export market of glass containers in 1945 increased by approximately 268 per cent over the 1937 to 1939 average. Increases were relatively steady with exception of 1942 and 1943, the years of extreme glass-container shortages in the United States. Although the full demand by foreign consumers has not always been met, exports of glass containers have been maintained throughout the war at a high level despite general license restrictions and export control under War Production Board Order L-103b.

The following table shows the actual dollar value of total glass-container exports for the years 1940 through 1945 as compared with the 1937 to 1939 yearly average:

1937 to 1939 (Average)	$3,186 844
1940	4,557,630
1941	6,593,084
1942	5,912,067
1943	5,640,752
1944	9,577,850
1945	11,722,882

Although the European pre-war markets were not a big factor in our export picture, it is safe to say that for the immediate post-war period these markets will develop considerably. At this time, these markets are in a highly abnormal condition as a result of the war and the accompanying dislocation of both industry and markets. With the disappearance of Germany as a source of glass containers, European consumers will naturally turn to United States producers for their supply of glass containers. As a result of the war, even such nations as the United Kingdom and Sweden, normally exporters, have had to resort to the importation of glass containers because of materials and labor shortages coupled with increased demand.

The following table shows that, with the exception of 1939, pharmaceutical and proprietary ware has made up approximately 50 per cent of all glass containers exported to Europe and nearly all of these went to the United Kingdom prior to 1943. During 1943 and 1944, Iceland was the heaviest purchaser of this category and the United Kingdom disappeared from the market. Prior to 1942, Norway, Sweden and the United Kingdom purchased nearly all of the beverage bottles exported to the European market. After 1942, the beverage-bottle market has been principally in Iceland. The same situation exists in regard to other glass containers with the heavier purchasers, Sweden, Switzerland and England, dropping off in 1943 in favor of Iceland, although the USSR entered the market in 1944 to become the heaviest European purchaser for that year, buying $25,570 worth of glass containers.

Total 1945 exports to Europe are valued at $219,329 or more than three times the 1944 total. This tremendous increase over any previous exports to that area is a possible indication of what United States exporters of glass containers may anticipate during the rehabilitation period in the war-torn areas of Europe:

(*Continued on page* 254)

Reprinted from the Glass Packer

METALLURGICAL ASPECTS OF X-RAY TUBE MANUFACTURE

By M. J. ZUNICK

Metallurgical and Chemical Engineer
General Electric X-Ray Corp.

Introduction

X-ray tubes are only a small part of the current vast field of vacuum tubes. Their manufacture, however, is replete with problems not commonly found in the general field of vacuum tube manufacture.

X-ray tubes are manufactured on a relatively small volume basis and it is only recently that mass production techniques have been considered for some phases of their manufacture. The large number of types and intricacies of manufacture definitely restrict the use of mass production methods. For this and other reasons, x-ray tubes are among the most expensive vacuum tubes, equal in value to large radio transmitting tubes. The production volume is measured on the thousand basis rather than hundred thousand, as is the case with radio receiving type tubes. The life span of an x-ray tube is relatively long and it is not unusual for one to be in service for ten or more years. Replacements are, therefore, generally infrequent. Uses of x-ray tubes fall into two main classes, as follows: I, Medical—a. radiography, b. therapy; II, Industrial—a. radiography, b. diffraction. Generally speaking, special types of tubes are required for each of the above subclasses; however, in some cases the same type of tube is used for more than one purpose. Representative tubes of each subclass are shown in Figures 1 to 5.

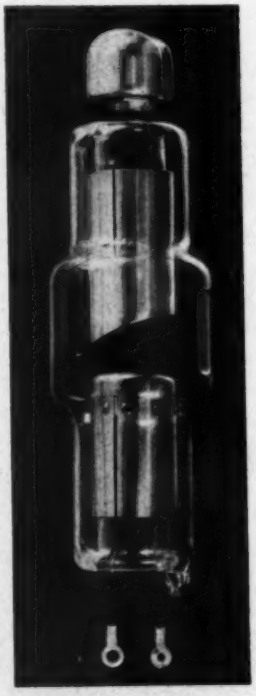


Fig. 1 — Medical radiographic type x-ray tube. Stationary anode.

The common x-ray tube appears to be simple in structure as indicated in Figure 6. However, the manufacture of component parts in their assembly require extremely close attention to all processes and inspection operations. Many of the processes are unique to the manufacture of x-ray tubes and require special equipment not ordinarily found in the metallurgical processing plant.

Physical Requirements of an X-Ray Tube

The physical requirements of an x-ray tube are exceptionally severe, and those of interest from a metallurgical standpoint are (1) density and melting point of targets and anode castings which have a direct bearing on loading and heat transfer, (2) purity of metals with respect to both metal impurities and absence of gases, (3) cleanliness of all surfaces and avoidance of low melting metal impurities, and (4) chemical composition especially in the case of low expansion metal sleeves.

Fig. 2—Medical radiographic type x-ray tube. Rotating anode.

With the advent of forged tungsten, as developed by Dr. D. W. Coolidge,[1] the hot cathode x-ray tube came into prominence. Since that time, tungsten has been universally used as a target material whenever total white radiation is desired. The advantages of tungsten for use as a target material in x-ray tubes are its melting point, 3370° C, which is the highest of all metals, its high density and atomic number, which are advantageous from the standpoint of intensity of x-rays produced, and its relatively high heat conductivity. The heat conductivity of tungsten is only surpassed by silver, copper, gold and aluminum. Another very advantageous property of tungsten is its extremely low vapor pressure at high temperature. The x-ray manufacturer is well pleased with nature for having endowed him with a near perfect target material.

Copper is used for the anode body for reasons that may not be too obvious to the reader, the most important of which are its practically ideal heat conductivity and its relatively low price and availability. It does not alloy with tungsten, but wets it, forming a firm bond, and its melting point, although far from ideal when regarded in view of heat loading, is especially advantageous with respect to casting operations. The vapor pressure is sufficiently low at high temperatures not to interfere with normal operation of the tube.

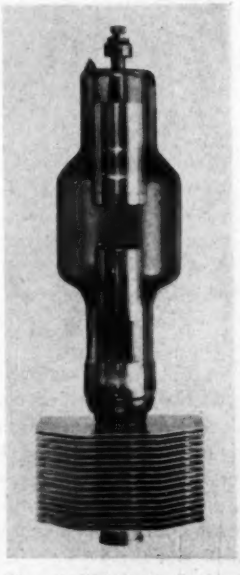


Fig. 3—Medical therapy type x-ray tube. (Also essentials same as used for industrial radiography.)

Copper has no counterpart for use in x-ray anodes. Silver, which might be used, has the one objection of relatively high cost. Other minor objections, such as lower melting point, also exist but these would not preclude its successful use.

The target in a stationary anode tube (medical radiographic type) must withstand loadings on the order of 200 milliamperes at 80 kilovolts distributed over an area approximating 0.155 sq. cm. The exposure times are short, being on the order of 1/10 of a second. Thus the momentary intensity (for example, in chest radiography) of heat loading is 80,000 x 0.2/0.155 or 103,000 watts/cm.[2] Heat input is generally calculated without considering the approximately 1 per cent of energy consumed in production of x-rays. Practically all of the heat must be dissipated by conduction through the copper anode, for little is dissipated by emission either from the target[2] or the copper anode. The temperature of the tungsten target during the loading period cannot be determined by pyrometric methods for obvious reasons; however, such temperatures have been calculated to be as high or higher than 2600° C. at the surface.[2] The only method available for actually determining the loading which a particular tube will withstand is to determine by operation the wattage at which the tungsten will melt and assume a 10 to 20 per cent reduction of that wattage as a safe operating load.

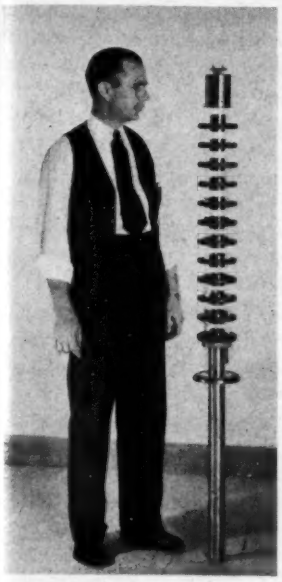


Fig. 4—Industrial radiographic type x-ray tube (also used for medical therapy).

The steel cathode of an x-ray tube aside from maintaining scrupulous cleanliness offers little difficulty of a metallurgical nature. The rather intricate slot in the face of the cathode, in which the tungsten filament is mounted, must be machined to an accuracy of .001 in. The filament, before positioning in the slot, must be heat treated to remove all strains, yet must have sufficient strength to permit handling and assembling by hand. The filament must be positioned with respect to the sides and bottom of the slot to within .001 in. and this position must be maintained throughout the life of the tube, otherwise the critical focal spot size will be affected.

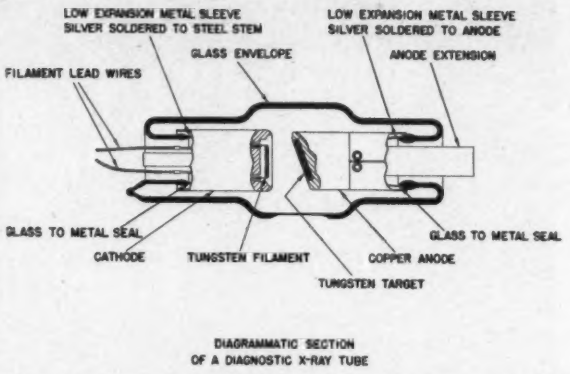


Fig. 6—Diagrammatic Section of a diagnostic x-ray tube.

Glass used as envelopes in x-ray tubes is of the borosilicate type. Glass is chosen to meet specific requirements of individual x-ray tubes. One important requirement of glass for x-ray tubes is that it contain no appreciable quantities of elements above calcium in the atomic chart, for even a fraction of one per cent of such elements will filter out substantial quantities of x-ray. Since the subject of glass in electronic tubes is of a special nature, it will not be discussed in detail in this article. A comprehensive discussion of this subject was recently published by H. C. Steiner.[3]

The sleeves to which the glass envelope is sealed must be made of a metal that has a coefficient of expansion approximating that of the glass. Very few metals meet this requirement in a broad sense; actually only two commercial compositions, namely, 42 per cent nickel steel and a high nickel-cobalt ferrous alloy, are generally used by the x-ray manufacturer. Copper sleeves can be used but have the objections of low strength and of being too easily oxidized. The ferrous alloys will be discussed in detail under the heading entitled "Glass to Metal Seals."[4]

The rather recent expansion in the uses of x-ray diffraction tubes and other requirements have necessitated the development of a material that is pervious to long wave x-rays. The recent development of the beryllium window x-ray diffraction tube has met all the requirements for efficiently generating and transmitting long wave x-rays. The metallurgy of beryllium has been an interesting subject for many years, and although a truly malleable beryllium has not yet been developed, the present art has been developed to a point where no particular difficulty is experienced in producing vacuum tight discs as required for x-ray tubes.[5,6,7,8]

X-Ray Tube Anode

The preparation of the x-ray tube anode requires more metallurgical thought and processing technique than the

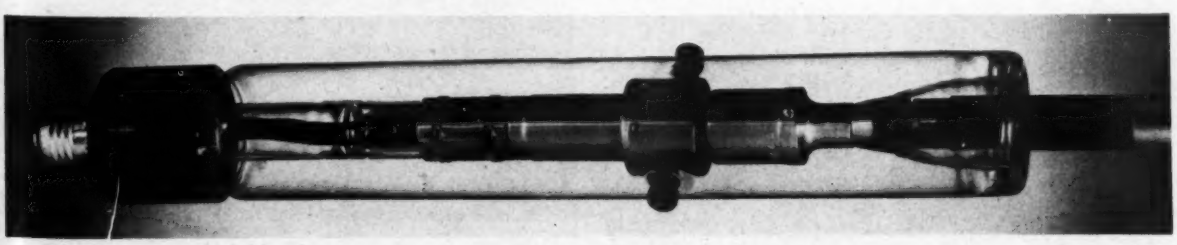


Fig. 5—Diffraction type x-ray tube (with beryllium windows).

Fig. 7—Hydrogen atmosphere furnaces with molybdenum resistance heating elements. Equipped with hydrogen gas curtain.

remaining parts of the tube combined. This is the result of the strict requirements placed on the purity and density of the target materials as well as the soundness of the anode castings.

In all cases, except in most x-ray diffraction tubes, the target consists of rolled and/or forged sintered tungsten bar. The tungsten sheet is specially prepared by the metal manufacturer to meet the strict requirements of the x-ray tube industry. Tungsten for x-ray tube targets must be dense and free from cracks and laminations. The targets are prepared from the tungsten sheet by cutting with abrasive wheels and in the case of round targets by punching the sheet at relatively high temperatures. Heating for punching operations and for strain relief is done in an electrically heated pure hydrogen atmosphere furnace similar to the one shown in Figure 7.

Most x-ray diffraction tube targets consist of a number of metals other than tungsten; for instance, molybdenum, iron, cobalt and nickel. In all cases the targets must be made from highly purified powders, for under certain conditions as little as .01 per cent of a metallic impurity may interfere with the results obtained in x-ray diffraction work.[7-9] Chromium target diffraction tubes are used frequently and these are made by the simple method of electroplating the surface of the copper anode with chromium to a specified thickness. In many cases copper radiation is needed and this type of tube requires no target material for the anode itself serves as the target, providing it is sufficiently pure.

Anodes are cast in vacuum furnaces of which two types are generally used. The Arsem type, although cumbersome, permits casting anodes in relatively large quantities at one time and consists of a large steel shell (surrounded by water for cooling) and heated with internal graphite resistance elements. The other type consists of a water cooled vacuum bell jar system and melting is accomplished by a high frequency induction generator.[10] A typical example of the latter type furnace is shown in Figure 8. Vacuums on the order of .01 to .20 millimeters must be maintained to obtain non-porous, gas free castings.

De oxidized types of copper must be used for castings, otherwise porous, gaseous castings will result. Calcium boride deoxidized and OFHC copper may be used with equally good success. In general, wrought copper in round rods is used in diameters to closely approximate the size of the crucible-mold, for space is at a premium in a vacuum furnace.

The crucible-molds and component parts are machined from solid graphite to a tolerance of from .0005 in. to .002 in. They are loaded for the casting operation as shown in Figure 9. The crucibles are reused a great many times since the castings are readily removed without damaging them.

Diffraction tube targets such as iron, nickel and cobalt, which tend to alloy with molten copper, are silver soldered into the copper anode, using various commercial silver solders.

All castings are radiographed prior to machining to determine their soundness. The assembly as shown in Figure 9 is simple compared with many which are cast with graphite insert to form a cup-like structure. This latter type, unless all processing is carefully controlled, is difficult to produce to the required specifications.

All anodes are machined to close tolerances for in practically all cases a low expansion metal sleeve must be soldered to the anode (see Figure 6). The tungsten targets in all cases are wet ground to a fine finish and in the case of the large rotating anode (see Figure 2), the tungsten is subsequently electrolytically polished to a mirror finish.

The rotating anode type of tube (see Figure 2) has an anode supported internally on two sets of ball bearings mounted on a stationary stem. The anode itself acts as rotor and is actuated by a stator mounted outside of the glass envelope of the tube. During operation, the bearings must operate at temperatures as high as 600°C with the anode rotating at about 3,000 R.P.M. The balls

Fig. 8—Vacuum furnace with high frequency induction heater.

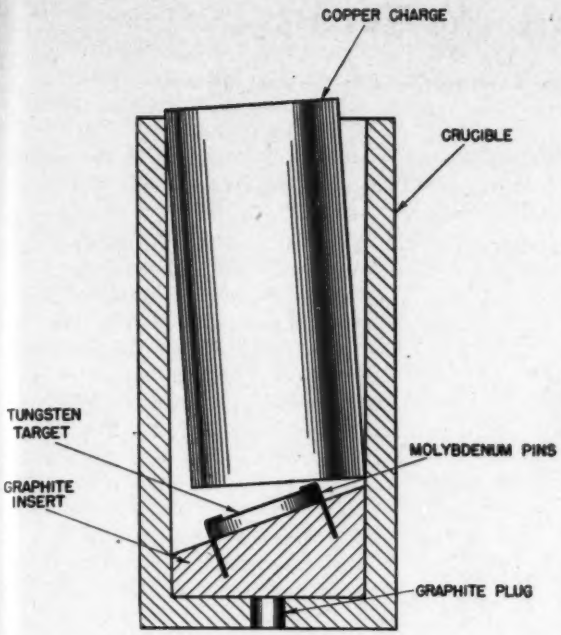


Fig. 9—Typical arrangement of crucible-mold prior to placing in furnace.

and races are made of high speed tool steel hardened to 63-65 Rc and they are lubricated with a thin metallic film after the tube is completely evacuated and sealed-off. The lubricating film consists of barium evaporated onto the balls and races from an electrically heated barium cored iron wire.[11]

X-Ray Tube Cathode

The cathode in an x-ray tube consists of a hot tungsten filament located within a slotted open cup made of any good grade of C.R. steel. It is supported either on a glass pinch seal by means of clamps or on a steel stem which in turn is copper brazed to a low expansion metal sleeve. The metal sleeve also serves as a means for introducing electrical leads insulated by glass eyelets.

The filament is originally wound on a molybdenum mandrel and permanently set by heat treating in a hydrogen furnace. Close tolerance must be met as the filaments must be permanently mounted in the slot of the cathode cup to a tolerance of .001 in. with respect to the edges and bottom of the slot.

Hydrogen furnaces similar to the one shown in Figure 7 are indispensable for treating tube parts. Heat treating and brazing tungsten and molybdenum parts can be successfully accomplished only in a reducing atmosphere. Any parts which may have become oxidized during processing are readily cleaned up by heating them in the reducing atmosphere of the hydrogen furnace. And, parts which have been fired in a hydrogen furnace are more easily degassed in the final tube during exhaust operations.

The bell jar vacuum furnace as shown in Figure 9 is used chiefly for preliminary degassing parts and assemblies before sealing into the tube. When parts and assemblies are processed in this manner, degassing time of the tube is reduced considerably. This type of furnace permits preferential heating of certain portions of the assemblies. The filament and support in the assemblies shown inside the furnace are made of tungsten and molybdenum respectively and they can be heated to as high as 1600°C, where as the glass portions of the assemblies remain at temperatures well below the sagging point of hard glass (600°C). The bell jar vacuum furnace is also used for silver soldering assemblies where fluxes required if soldered in air are objectionable with respect to difficulty in removing residual flux from inaccessible recesses.

Choice of furnaces for preliminary firing (degassing) operations rests upon many factors. In those cases where parts are not subjected to excessive temperatures within the tube, they are generally fired only in the hydrogen furnace because of lower processing costs. The two types of furnaces are not restricted to firing cathode parts and assemblies. The hydrogen furnace is used for other operations such as plating tungsten buttons prior to casting operations with pure copper by reduction of a layer of cuprous oxide, copper brazing steel parts and prefiring of metal sleeves prior to application of wetting glass. The bell jar vacuum furnace, for instance, is also used to silver solder and degas certain special types of anodes. However, its major use remains that of degassing cathode parts and assemblies.

The x-ray tube industry was one of the pioneers of the hydrogen furnace and the high frequency induction vacuum furnace for industrial use. For years techniques and equipment considered by industry as restricted to laboratory research personnel have been used in production of x-ray tubes.

Glass to Metal Seals

The hard glass envelope of an x-ray tube in most cases is sealed to a low expansion alloy sleeve which in turn

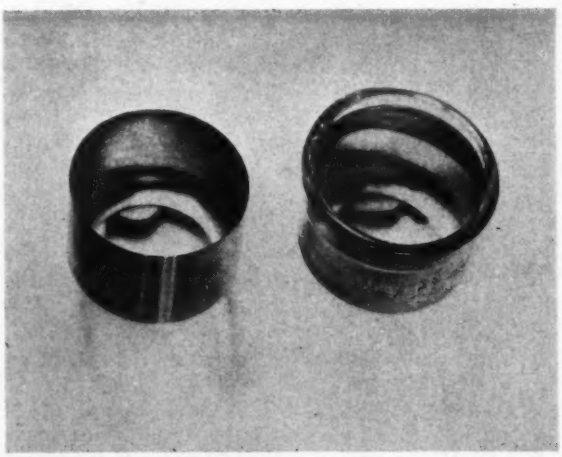


Fig. 10—Typical low expansion alloy sleeves with and without wetting glass.

is soldered, brazed or welded to metallic components of the anode or cathode. The sleeves are formed from sheet on a standard punch press using a simple series of dies in those cases where deep draws are required.

Two types of low expansion alloys are normally used for the sleeves; namely, the cobalt-nickel-iron alloy represented by commercial products such as Fernico and

(*Continued on page* 260)

INVENTIONS AND INVENTORS

A Summary of Recently Issued Patents of Interest to the Glass Industry

Feeding and Forming

Patent No. 2,398,465 was assigned to the S & Z Manufacturing Company by the inventors, Samuelson and Zappia. It was divided from the application of their earlier patent, No. 2,363,999, which was reviewed in an earlier issue of The Glass Industry.

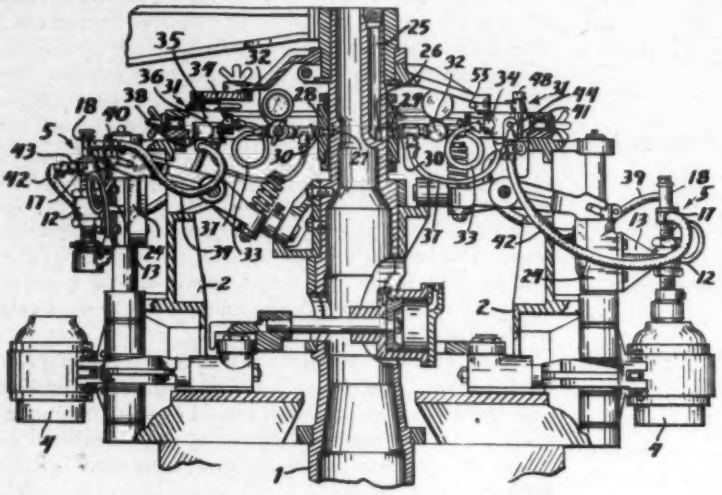


Fig. 1. Pat. No. 2,398,465. S & Z Manufacturing Company. Forming Machine.

Fig. 1 shows a vertical section through the blow table of a machine of the Lynch type. This patent is directed particularly to a valve arrangement by which relatively low pressure blowing air is first admitted to the parison to expand the bottle and then higher pressure cooling air is admitted to the botle and allowed to escape, thus rapidly cooling the bottle.

Air comes to the machine through a pipe 25 in the central standard 1 at the highest pressure that will be required. This air passes to a reducing valve 32 which lowers the pressure to the extent desired for blowing. Blowing air passes through a flexible pipe 33 to a valve 31. A second pipe 37 by-passes the reducing valve and delivers high pressure air to the same valve 31. This valve has a rotary member carrying a roller 48 which is engaged at the proper times by two cams. Flexible pipes 39 and 42 connect the valve 31 with the blowhead 5. The construction is such that low pressure blowing air is first admitted to the parison and confined there while it expands due to the heat of the glass and the molds. The next movement of the valve admits high pressure cooling air to the bottle and at the same time vents the interior of the bottle to atmosphere. This provides for a rapid cooling of the bottle and thus increases the production of the machine.

The most desirable pressures in the manufacture of a pint flask were found to be about 20 pounds for blowing and 35 to 40 pounds for cooling. On a round gallon, 6 pounds was used for blowing and 35 to 40 for cooling. It is suggested that steam may be used both for blowing and cooling.

Patent No. 2,398,676 was assigned by the inventors, Snyder and Bennett to Forter-Teichmann Company. The particular object of the invention is the high speed production of glass reflectors for sealed beam automobile headlights. It is necessary that the shape of such reflectors shall be most accurate in order to make a satisfactory headlight.

The general arrangement of the press is shown in Fig. 2. Glass is delivered by any well-known feeder indicated at 4 to a chute 5 which guides the gobs G to a series of molds 1 carried by an intermittantly advancing chain comprising links and cooperating parts 11, 12 and 13. A cylinder 19 acts through a rack 18 and gear 17 to advance the chain step by step in the direction of the arrow a. A gob delivered to a mold 1 in position A is then advanced to the pressing station B.

The press comprises a properly shaped plunger carried by a cross-head 6 on the lower end of a piston rod 7 reciprocated by a fluid-pressure cylinder 8.

One of the features of this invention resides in the provision means carried by the pressing plunger for bringing each mold into exact alignment with the plunger before the pressing operation. Another feature is the provision of means for holding each pressed article in its mold until the article R reaches the proper position to be delivered to a conveyor 37.

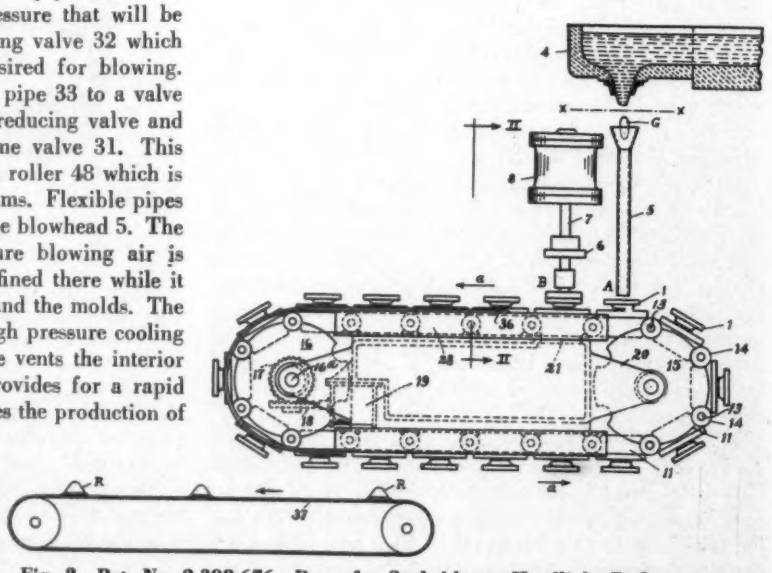


Fig. 2. Pat. No. 2,398,676. Press for Sealed-beam Headlight Reflectors.

Glass Compositions

Patent No. 2,398,494 relates to low-melting enamels or glazes for application to glassware or ceramic articles, which contain fluorine or metallic fluorides. It was assigned to E. I. du Pont de Nemours & Co., Inc. by Alden J. Deyrup.

Patent No. 2,338,099, previously granted to the same inventor, disclosed a fluorine enamel and the present patent discloses a method of increasing the smoothness of the coating produced by the earlier composition although it is also useful with other batches. The improvement of the later patent resides in the step of heating a coarse, unground, fritted fluorine-containing enamel for at least one hour to a temperature between 400 and 580°C. The vitreous material is fritted but not ground to a fine powder. The inventor is unable to explain the reason for the improved glass and smoothness obtained by this method.

One example of a batch which may be used in carrying out this method is taken from the above mentioned prior patent. This composition is as follows, the percentages being given by weight, based on the total weight of the enamel.

	Per cent
Lead oxide—PbO	42.4
Silica—SiO_2	26.3
Zirconium dioxide—ZiO_2	8.8
Sodium fluoride—NaF	5.8
Sodium oxide—Na_2O	3.0
Boric oxide—B_2O_3	7.8
Titanium dioxide—TiO_2	3.2
Cadmium oxide—CdO	3.2

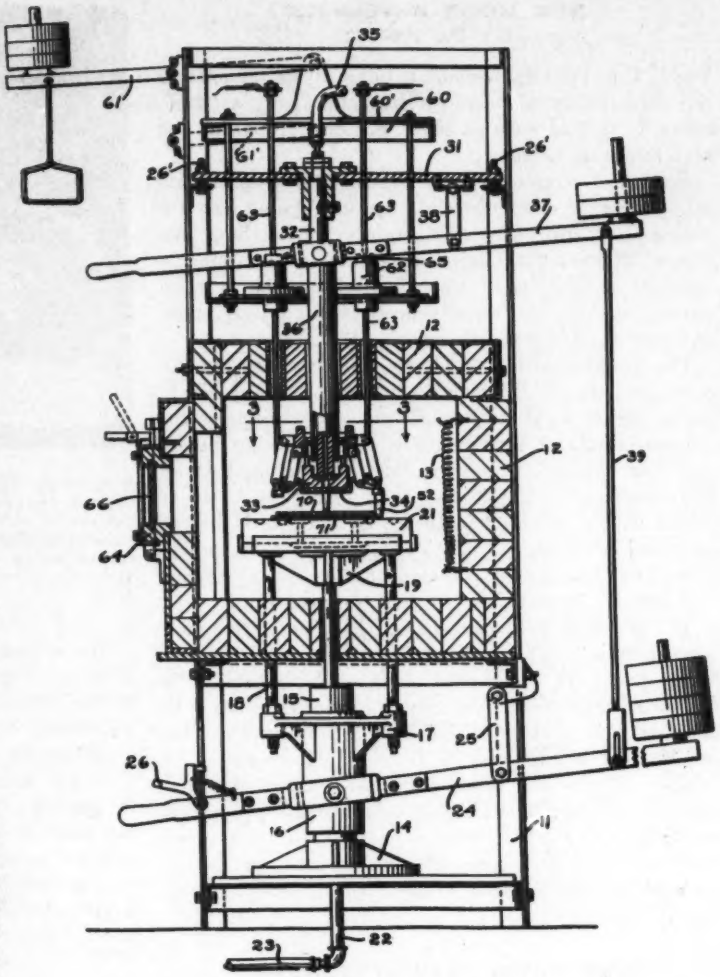


Fig. 3 Corning Double Glazed Cell Forming Machine.

Patent No. 2,398,525 was assigned to Corning Glass Works by David E. Gray. The machine is for the purpose of reheating, reshaping and fusing glass sheets and is intended particularly for making double glazed cells as used in windows.

As shown in Fig. 3, a frame 11 carries a kiln 12 having heating coils 13 connected with an automatic regulating system. A base 14 carries rods 18 supporting a vacuum chuck 19 inside the kiln. A counterbalanced hand lever 24 is provided for raising and lowering the chuck. An upper chuck 33 is supported from above and it can be reciprocated by a lever 37. The levers are connected by a link 39 to prevent accidental damage to the parts. Electrodes 63 carried by a frame 60 depend into the kiln 12.

When a double glazed cell is to be made, two sheets of glass 70 and 71 are placed on the face 21 of the chuck 19 and positioned against the fingers 52. The lever 24 is then operated so that the sheet 70 is picked up by the upper vacuum chuck 33. A lever 61 is then actuated to bring the electrodes 63 into contact with the corners of the sheet 70 to soften the marginal portions of the sheet. The lever 37 is then lowered to bring some folding bars into position to bend the edges of the sheet into the form of a shallow inverted disk. The lever 24 is then raised to bring the sheet 71 into contact with the down-turned edge of the upper sheet. The sealing is accomplished by the electrodes 63. The completed unit is released by opening the two vacuum chucks to atmosphere when the cell may be removed by a portable vacuum chuck inserted through a door 66.

Patent No. 2,398,530, granted on the application of Joseph G. Hooley, relates to phosphate glasses which absorb most of the visible light while transmitting the ultraviolet. Such glass is commonly known as "black glass." A phosphate glass is one in which the acidic constituent is phosphoric oxide instead of silica. This glass is unusually stable as to devitrification and, therefore, well adapted for tubing which has to withstand repeated reheating while being worked. It is believed that this is the first black phosphate glass ever proposed having a molecular percentage ratio P_2O_5/RO greater than one.

The following table gives eight examples of batch compositions calculated in percent by weight, all of which produce improved glasses. Compositions II and VII are particularly recommended.

(*Continued on page* 264)

NEW RESIN DEVELOPED BY DU PONT

The E. I. du Pont de Nemours & Company has announced the development of a new resin, known only as BCM, which is said to have excellent bonding properties and high resistance to heat.

Structural panels made from BCM, reinforced with glass fabric or other materials, are undergoing tests for automobiles, airplanes, refrigerators and washing machines. The material is also being tested to determine its suitability in the manufacture of products such as transparent coatings for wood veneers, tooling jigs, entire sections of sinks and decorative panels.

The liquid resin is used chiefly with glass fabric laminates at present, although it may also be applied to paper, hemp, wood and various cloths, according to the announcement. It requires only a short curing period and low laminating pressure, and can be used as an impregnating and laminating resin either by itself or mixed with a polymer. In the cured state, BCM has no odor and is resistant to most organic materials. Absorption of water, and other common solvents such as acetone and ethanol, is very low, from 1 to 2 per cent.

The new resin is thermosetting, which means that once formed under heat it retains its shape when reheated. When cast as a transparent sheet on table tops, it is further stated, it has a permanent high-gloss finish. In addition, thin veneers to which BCM has been applied can be bent without crazing or peeling the resin.

The company also found that a wide range of colors could be obtained by adding oil-soluble dyes or pigments to the resin. Cast BCM may be worked with high-speed tools easily by the same methods as used for methacrylates like the familiar crystal-clear "Lucite" acrylic resin.

NEW GLASS LENS DEVELOPED BY AMERICAN OPTICAL

A new image-correcting glass lens has been developed by the American Optical Company, according to a recent announcement. The new lens is expected to produce larger, clearer television pictures from postwar home television receiving sets.

Dr. E. D. Tillyer, Research Director, reports that its unique wave-like curves correct aberrations caused by projecting television tube images on a reflecting mirror used in the optical system to enlarge the images.

The lens was a war development and is made of a durable, stable glass that will retain its optical properties during the entire lifetime of a television receiver. Dr. Tillyer announced that the lens is produced by a new method of mass production developed during the war by American Optical Company and disclosed that the company has manufactured many thousands for military devices whose uses have not yet been revealed by the government. The lenses are said to be more than 10 times as fast as a f/2.0 camera lens.

Dr. Tillyer further explained that the wave-like curves of the correcting lens, which compensate for the spherical aberrations introduced into television pictures by the reflecting mirror, are produced by heating a flat piece of glass until it flows into the specially curved surface of a refractory on which the glass is placed.

Improved television reception is aided by a new lens-mirror combination pictured above. The reflecting glass mirror at the right enlarges pictures from the television tube, but also introduces aberrations as shown by the distorted image of the girl holding the mirror. The aberrations are corrected by the specially curved glass lens at the left.

The refractory serves as a mold in some respects and is made of a special composition that does not adhere to the glass and yet permits it to assume the desired curvature. The lens is then ground and polished to a sparkling finish.

At the same time, announcement was made of a reflecting glass mirror as a companion piece to the correcting lens. It is said that the combination permits reception of screen images five times larger than the prewar variety. The reflecting mirror is ground and polished by modern, highly accurate lens grinding methods.

NEW APPOINTMENTS AT UNIVERSITY OF ILLINOIS

The University of Illinois has announced the appointment of A. W. Allen as Instructor in Ceramic Engineering to start with the present semester. Previously, he has been a special research associate on the Army Air Forces project.

Mr. Allen received his B.S. degree in Ceramic Engineering from the Missouri School of Mines and Metallurgy in 1941, and his M.S. degree in Ceramic Engineering from Virginia Polytechnic Institute in June 1942. After holding a research fellowship at Virginia Polytechnic Institute, he joined the staff of Harbison-Walker Refractories Company as a research engineer.

Other appointments announced at the same time were: A. L. Friedberg as a half time assistant; T. F. Newkirk, R. F. Kimpel and W. A. Graff as Special Research assistants on the Army Air Forces Research project; and Frank Klame, also on the Army Air Forces project.

FORTER-TEICHMANN OPENS CHICAGO OFFICE

Forter-Teichmann Company and Forter-Teichmann International, Pittsburgh, Pa., associates of Loftus Engineering Corporation, have announced the opening of a branch office in Chicago, Illinois.

The new office will be in charge of John H. Loux and will be located at 185 North Wabash Avenue.

GJ Research Digest

Practical Interpretations of Glass Technology

The Viscosity and Working Characteristics of Glasses, Parts IV and V

The previous measurements by Boow and Turner of the temperature and viscosity of glasses at different stages in the processes of gathering and shaping by hand have been supplemented by a study of the temperatures and viscosities during the shaping processes as carried out by gravity-fed automatic machines of different types. The results of this study appear in the August, 1945, issue of the *Journal of the Society of Glass Technology*.

In this investigation (Part IV), the two glasses studied had the percentage compositions, respectively: Colorless, SiO_2 74.1, R_2O_3 0.85, CaO 9.7, MgO 0.1, Na_2O 15.2; Amber, SiO_2 73.75, R_2O_3 1.25, CaO 9.4, Na_2O 15.6. The machines working these glasses included the Hartford Fairmount press and blow, the Lynch LA, the Lynch 10 and a mechanical press. The weights of the various types of containers produced by these machines during this study ranged between 3 and 23 ounces. The temperatures and corresponding viscosities of the glass at each stage of operation were found to be influenced by the conditions of manipulation (type of machine), the weight and the color of the glass. There is a range of temperature and viscosity within which each shaping operation can be accomplished. The ranges of viscosity (in poises) of the glasses were: gob formation, 2,000-11,000; when leaving the parison mold, $1.8 \times 10^4 - 6 \times 10^4$ (mean values) with viscosities in the hot interior at $6 \times 10^3 - 8 \times 10^3$; entry into blow-mold, $9 \times 10^4 - 2.3 \times 10^5$ (mean values), with viscosities in the hot interior of $1.5 \times 10^4 - 5 \times 10^4$; when discharged from the blow-mold, interior values in the base of the bottle $10^6 - 10^8$. These values, which are wide enough to embrace both glasses examined, are derived from methods of operation at a single works. The conditions of temperature and viscosity suitable at each stage for optimum efficiency of production when using any one glass and a particular type of machine need to be worked out by further systematic study. The need is emphasized for careful determination of the specific heat of glasses over a wide temperature range.

In Part V of this study, temperature measurements on the glass and on the mold parts were made during the manipulation by semi-automatic machines of five pressed objects of colorless glass, varying in weight from 9 oz. to 58 oz. The mean range of viscosity values of the glass (in poises) at the different stages of manipulation as carried out in an individual factory were found to be as follows: gathering, 1200 to 2200; entry into the press mold, 2000 to 5000; commencement of pressing, 3000 to 6000; completion of pressing $10^{4.7}$ to $10^{6.0}$; and at the removal from the mold, $10^{5.9}$ to $10^{7.1}$. These viscosities are slightly lower than those noted in the corresponding stages of hand and automatic manipulation of glass, mainly by blowing processes, as quoted in Parts III and IV; a fact due in these pressing processes to working at somewhat higher temperatures. Some measurement of temperatures at different parts of the molds employed were also made. Finally, an attempt has been made to draw up a heat balance between the glass and the mold. This calculation illustrates the possibility of calculating a more accurate heat balance when a thorough survey of mold temperatures has been carried out.

Geology and Glass Sand Resources, Central Arbuckle Mountains, Oklahoma

The Oklahoma Geological Survey in Bulletin No. 65 by William E. Ham reports on the glass sands found in that state. An abstract of this bulletin follows: Deposits of high grade glass and in the central part of the Arbuckle Mountain region of south-central Oklahoma have been worked since 1913 and have accounted for virtually all high silica sand produced in the state. At present, there are three plants, one each near Sulphur, Roff and Mill Creek, and a fourth is under construction at Hickory. The district in 1944 produced an estimated 130,000 tons of sand with a value of about $235,000, nearly all of which was shipped to glass plants in Oklahoma and Texas.

The worked deposits are in the sandstone members of the McLish and Oil Creek formations of the Simpson group (Ordovician) which are lithogically similar to and approximately the same age as the St. Peter sandstone of the upper Mississippi Valley.

Detailed mapping with aid of aerial photographs shows that the glass sand beds occur in structurally complex synclines and on the margins of large anticlines, in association with younger sedimentary formations that range in age from upper Ordovician (Trenton) to late-middle Pennsylvanian (pre-Virgil). These strata lie on the very thick Arbuckle dolomite of Cambro-Ordovician age and are covered on the northwest margin of the district by the overlapping Pontotoc conglomerate of late Pennsylvania age. The synclinal and anticlinal structures were developed in early Pennsylvanian (pre-McAlester) time and modified by faulting, more complex folding and some over-thrusting in late Pennsylvanian (post-Hoxbar: pre-Pontotoc) time. Erosion has dissected one prominent over-thrust sheet in the Sulphur area, forming 14 outliers or Klippen and uncovering a wide outcrop of high grade glass sand. The downfolding and graben-like faulting, however, are largely responsible for preserving the glass sand beds from complete removal by post-Pennsylvanian erosion. Workable deposits accessible to railroad transportation occur in the Mill Creek syncline, Sulphur syncline, Hickory syncline, on the south and west flanks of the Belton anticline and on the northwest flank of the Hunton anticline. Outcrops of Simpson and younger

strata covering about 50 square miles are shown on detailed geologic maps of these areas. The reserves of glass sand in the district are enormous.

The glass sands are massive or poorly stratified sedimentary beds 150 to 400 feet thick associated with a thicker sequence of limestone and shale strata. They crop out generally in curving bands, 500 feet to 1.5 miles wide, that are related to structural trends. The deposits are worked where the dips are low to moderate and the sand is exposed over a wide area. The sands are loosely consolidated and weather to gently rolling, forested plains on which actual exposures of the sand body are uncommon, so that prospecting must be done by geological mapping together with exploratory pits or drill holes. The overburden ranges in thickness from 3 to 20 feet, averaging 5 to 10 feet, and consists of loose iron-stained sandy soil or alluvial clay. The practice in the Oklahoma district is to remove the overburden and quarry the sand by hydraulicking from an open pit 30 to 70 feet deep. The sand is beneficiated chiefly by washing, although one company uses tabling and flotation to remove pyrite. Processed sand is marketed as "moist" or dry, depending on specifications of the consumer.

The sands are white to pale buff or greenish and are composed chiefly of rounded, frosted and pitted grains of quartz. They contain 0.04 to 0.71 per cent detrital feldspar (orthoclase, microcline and albite) and an inconstant but small amount of the clay mineral illite. The heavy minerals of authigenic origin, pyrite and its alteration product limonite, are the chief sources of iron. Most of the iron is present as a thin coating of limonite on the sand grains. Detrital heavy minerals are schorlite tourmaline (dominant) zircone (common), and garnet, rutile, ilmenite, cylonite and epidote (rare); they contribute practically no iron to the sands. The crude sands contain 99.57 to 97.82 per cent SiO_2, 0.09 to 0.40 per cent Fe_2O_3, 0.04 to 1.16 per cent Al_2O_3, and very small quantities of CaO and MgO. The clay and most of the iron minerals are removed by benefication, so that the processed sands contain about 99.85 per cent SiO_2, 0.03 to 0.044 per cent Fe_2O_3, and 0.04 to 0.09 per cent Al_2O_3. Such sand is suitable for all but optical grades of glass.

Sieve analyses show that the texture of the sands is fine-grained, 83 to 90 per cent being in the fine and very fine sand grades of the Wentworth scale. The average median diameter of the sands is 0.142 mm. and the average sorting coefficient is 1.20. Although considerably finer than the St. Peter sand of Illinois, Missouri and Arkansas, the fine-sized Simpson sands have been used successfully for 32 years in Oklahoma glass plants, producing excellent quality containers, table glassware and plate glass.

OWENS-ILLINOIS APPOINTS MEDICAL DIRECTOR

According to a recent announcement made by Owens-Illinois Glass Company, Dr. Charles Francis Shook, retired Colonel in the United States Army Medical Corps, has been appointed to the newly created position of Medical Director of the company. Dr. Shook will have complete charge of the company's medical program for its more than 21,000 employees, and will have headquarters at the Industrial Relations Division of Owens-Illinois in Toledo, Ohio.

Dr. Shook, who is a veteran of both World Wars, served as Deputy Chief Surgeon to Major General Paul R. Hawley for the European Theater. As Chief Surgeon of the Communication Zone in the Mediterranean Theater, Dr. Shook was in charge of supervision of hospitalization, evacuation of wounded, sanitation and hygiene of occupied areas and maintenance of medical supplies for all troops.

SILVERMAN HONORED BY AMERICAN CHEMICAL SOCIETY

At a meeting held in April in Atlantic City in connection with the convention of the American Cehmical Society, Dr. Alexander Silverman, head of the Chemistry Department in the University of Pittsburgh, was made National Honorary Member of Phi Lambda Upsilon, honor society of the chemists of America.

In acknowledging the honor, Prof. Silverman said that he considered it a recognition of the fine cooperation of his many colleagues during the forty years he has taught and directed researches in the University of Pittsburgh.

In 1930, Dr. Silverman received the honorary Doctor of Science degree from the University and in 1936 he received an honorary doctor's degree from Alfred University.

CORNING APPOINTS ASSISTANT TO TREASURER

The Corning Glass Works has recently announced the appointment of Thomas Waaland as Assistant to Treasurer. He will assume his new duties immediately.

Mr. Waaland joined the company in 1942 as a member of the production planning department and was later made assistant to the production manager at the main plant. In 1944 he was appointed assistant to the manager of the Technical Products Division and in 1945 became controller of both the Technical Products and Bulb and Tubing Division Divisions. Mr. Waaland retains the latter position in addition to his new duties.

A graduate of New York University where he received his Bachelor of Science degree in 1932, Mr. Waaland later did graduate work at Massachusetts Institute of Technology and was awarded the degree of Master of Science in Business Administration there.

PLANT EXPANSION BY MATHIESON ALKALI

In line with its program of expanding production and research facilities, The Mathieson Alkali Works has recently announced its intention to build a new pilot plant at Niagara Falls, New York. This will be the second recent addition to the company's facilities at Niagara Falls.

With a view to increasing coordination between research, sales development and plant operations, Mathieson recently reorganized its research department, with G. P. Vincent as Technical Director.

PITTSBURGH SECTION HONORS ROSS PURDY

The Pittsburgh Section of the American Ceramic Society recently gathered to honor Ross C. Purdy, national secretary, and the Society's national officers.

The meeting was opened by Dr. A. Paul Thompson of Mellon Institute, who is Chairman of the Section. Out of town guests and returned servicemen were then welcomed to the meeting by Harold E. Simpson, also of Mellon Institute, who was toastmaster of the evening.

Presentation of testimonial portfolio. Left to right: A. Paul Thompson, H. E. Simpson, Dr. Purdy and C. Forrest Tefft.

After the business of the evening was concluded, Toastmaster Simpson reviewed Dr. Purdy's background. He told how Dr. Purdy attended Ohio State University, gained experience on industrial jobs and established the department of ceramic engineering at the University of Illinois in 1905.

Dr. Purdy was assistant professor at Ohio State 1907 and then became Director of Research for the Norton Company. In 1922 he became general secretary of the American Ceramic Society.

When Dr. Purdy was being introduced to the assemblage, he was presented with a handsomely inscribed testimonial folio. Dr. Purdy accepted the folio and then began his recollections of 25 years spent in advancing ceramic technology and the Society of which he is secretary. He recalled that when he was president of the Society in 1909-1910, he advocated the general reorganization of the Society and its expansion through the formation of local sections, and how he continued his campaign through the years. In 1920, he became general secretary.

PERSONNEL CHANGES AT ARMSTRONG CORK

The Armstrong Cork Company has recently announced three new appointments to sales executive positions in its Glass and Closure Division.

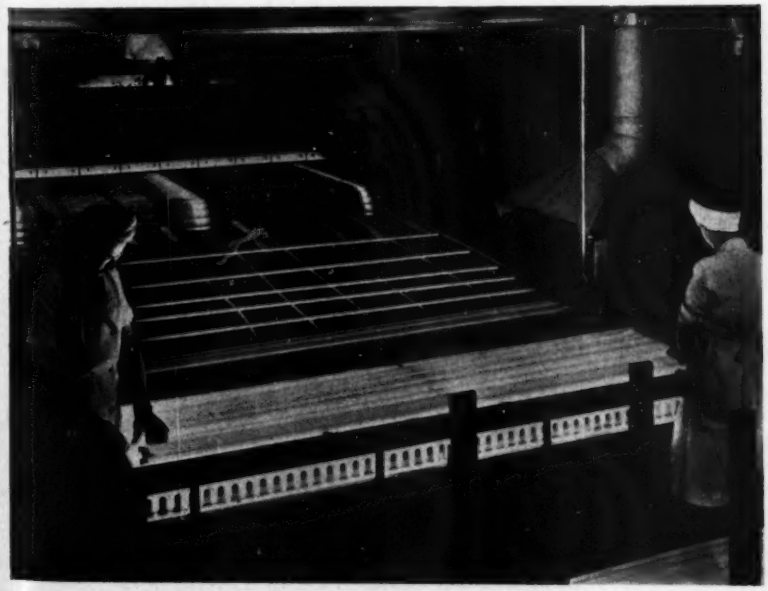
V. A. Game, who has been assisting in the glass container department for the past three years, has been appointed Assistant Commodity Manager for metal and molded caps. R. H. Hetzel, who has recently returned to the Glass and Closure Division after four years as assistant manager of aircraft sales in the company's Munitions Division, has been appointed Assistant Commodity Manager for glass containers.

The third appointment was that of W. W. Pedrick 3rd, who will assist in drug sundries sales. Mr. Pedrick was formerly assistant manager of the Ammunition Department of the Munitions Division.

SYLVANIA INSTALLS GIANT LEHR

Over one mile of fluorescent sign and lighting tubing is baked every hour in the giant oven recently installed at the Danvers, Massachusetts, plant of Sylvania Electric Products, Inc.

Believed to be the largest of its kind in the world, the new lehr speeds the production of fluorescent tubing to be used in sign making, custom lighting and standard types of long, narrow fluorescent lamps.



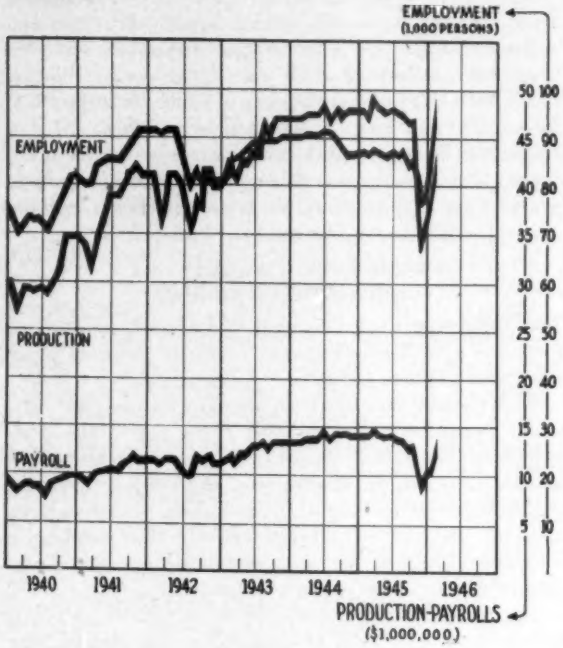
Temperature in the oven rises to 400°C. at the center and firmly bakes the fine-grained fluorescent powders to the inside of the glass tubing, giving the powders a uniform, fine-textured appearance and an imperviousness to chipping.

The tubing, coated internally with a solution of fluorescent powders, is fed into the machine on a 12 foot roller conveyor which slowly carries the glass through the baking oven. After spending three minutes under extreme heat, the tubing is gradually cooled to room temperature by forced draft blowers as it rolls onto the inspection unit.

On the inspection unit, a bank of fifty 30-watt standard white fluorescent lamps under a frosted glass plate plainly shows any flaws or defects, and the inspectors, who inspect each item individually, reject defective lengths of tubing. If the tubing passes inspection, both ends are sealed with cork stoppers to protect the cleanliness and sensitivity of the fluorescent coating.

CURRENT STATISTICAL POSITION OF GLASS

THE GLASS INDUSTRY'S INDEX



Activity in the glass industry during February 1946, according to the Production Index, rose 22 per cent to an estimated $47,600,000. The January figure was reported at $39,000,500. For February 1945, production was at an estimated $46,000,000, which is about 3 per cent less than for February this year. February 1946 production is the highest since that reported for June 1945, which was $48,000,000. Output for the first two months of 1946 is about $86,500,000.

Employment and payrolls: The total number of persons employed in the glass industry during February 1946, rose about 14 per cent to 99,700 employees. January employment was reported at 87,300 persons and during February 1945, employment was 87,600, which represents close to 14 per cent below February this year.

Payrolls for February 1946 were estimated at $13,000,000—approximately 22 per cent over the $10,600,500 during January. February 1945 payrolls were $14,500,000, or about 10 per cent over February 1946.

Glass container production for the month of March 1946, based on figures released by the Bureau of Census, was 9,872,373 gross, an approximate 9 per cent rise over the 8,986,852 gross produced during February. Production during March 1945 was 8,812,343 gross, or approximately 12 per cent below the corresponding month this year. Total production for the first-quarter period of 1946 is 28,703,492 gross, as compared with 24,338,519 gross produced during the same period in 1945.

Shipments during March also rose and were reported to be 9,839,971 gross. This figure represents close to 9 per cent increase over the 9,032,312 gross of glass containers shipped during the month of February. March 1945 shipments were 9,298,440 gross—about 5 per cent under March 1946. Total shipments made during the January-March 1946 quarter are 28,639,131 gross, in comparison with 25,150,302 gross shipped during the corresponding period in 1945.

Inventories at the end of March 1946 were 4,287,338 gross in comparison with 4,293,485 gross on hand at the end of February. Stocks on hand at the end of March 1945 were 4,803,219 gross.

The figures presented above covering production, ship-

(*Continued on page* 250)

GLASS CONTAINER PRODUCTION AND INVENTORY

(All figures in gross)

		Production March 1946	*Stocks March* 1946
Foods; Medicinal & Health Supplies; Chemicals, Household, Industrials; Toiletries & Cosmetics	Narrow Neck	3,197,197	1,789,193
	Wide Mouth	3,404,579	1,097,545
Dairy Products		355,891	169,889
Home Canning		177,517	403,840
Beverages, Returnable		570,971	386,049
Beverages, Non-returnable			
Beer, Returnable		768,994	94,844
Beer, Non-returnable		98,715	23,430
Liquors		882,955	227,352
Wines		297,149	73,506
Packers' Tumblers		118,405	21,690
Total		9,872,373	4,287,338

GLASS CONTAINER SHIPMENTS

(All figures in gross)

Narrow Neck Containers	*March* 1946
Foods	725,480
Medicinal & Health Supplies	1,184,004
Chemical, Household, Industrials	642,030
Beverages, Returnable	524,415
Beverages, Non-returnable	
Beer, Returnable	692,339
Beer, Non-returnable	98,735
Liquors	858,476
Wines	297,599
Toiletries & Cosmetics	609,269
Sub-Total (Narrow)	5,632,347
Wide Mouth Containers	
Foods	2,791,500
Dairy Products	341,760
Home Canning	170,542
Medicinal & Health Supplies	290,248
Chemical, Household, Industrials	130,428
Toiletries & Cosmetics	145,035
Packers' Tumblers	112,436
Sub-Total (Wide)	3,981,949
Total Domestic	9,614,296
Export Shipments	225,675
Total Shipments	9,839,971

ELECTRIC LAMP PRODUCTION, SHIPMENTS AND STOCKS FOR 1945

The Bureau of Census has recently issued a comprehensive report on the production, shipments, stocks and dollar values of electric lamps for 1945 representing the operations of twenty-six companies comprising virtually the entire electric lamp industry.

Accompanying its release reviewing the industry's activities, the Census Bureau has issued three tables: Table 1 shows production, shipments and stocks for 1945; Table 2 indicates domestic and export shipments for the year; and Table 3 gives production, domestic and export shipments with dollar values in each market and stocks on hand on a quarterly basis for the full year of 1945. This report represents the first time that quarterly data on the number of electric lamps by type of lamp has been published.

The statistics covering the first three quarters are revised and supersede previous data issued by the Bureau of Census for these periods. Data for the fourth quarter are preliminary and are partly estimated. Hence, total figures for the entire year are considered preliminary.

Tables 1 and 2 are shown below. Table 3, containing the same data as shown in 1 and 2 but on a quarterly basis, has been omitted from this report.

Table 1: ELECTRIC LAMPS: PRODUCTION, SHIPMENTS, AND STOCKS, 1945
(Thousands of lamps)

Product	Number of companies	Stocks at beginning of year*	Production	Shipments	Stocks at end of year
TOTAL	26	266,851	1,224,917	1,250,735	241,033
LARGE	18	179,899	867,235	877,651	169,483
Incandescent, 150 watt and under	16	143,674	712,704	715,686	140,692
Incandescent, over 150 watt	14	18,126	79,916	83,058	14,984
Fluorescent, RF and F[1]	5	13,879	36,950	42,583	8,246
Germicidal	3	.....	361	158	203
Photoflash	3	4,220	37,304	36,166	5,358
MINIATURE	14	83,800	318,933	334,438	68,295
Automotive, glass sealed beam	3	1,437	12,364	12,244	1,557
Other automotive	7	27,957	142,842	141,872	28,927
Miniature, other than automotive	14	54,406	163,727	180,322	37,811
MISCELLANEOUS	3	3,152	38,749	38,646	3,255
Christmas tree[2]	3	380	29,879	28,639	1,620
Electrical discharge[3]	3	2,772	8,870	10,007	1,635

[1]Does not include fluorescent Christmas tree on RP—12 "black light" but does include tubular, straight, and curved types.
[2]Includes fluorescent Christmas tree
[3]Includes glow, sodium, RP—12 "black light", photo-chemical, mercury, and sun lamps.
*Estimated

Table 2—ELECTRIC LAMPS: DOMESTIC AND EXPORT SHIPMENTS, 1945
(Quantities in thousands of lamps and values in dollars)

Product	Number of companies	TOTAL		DOMESTIC		EXPORT	
		Quantity	Value	Quantity	Value	Quantity	Value
TOTAL	26	1,250,735	$145,266,747	1,192,768	$138,233,572	57,967	$7,033,175
LARGE	18	877,651	119,302,417	839,773	113,293,035	37,878	6,009,382
Incandescent, 150 watt and under	16	715,686	62,193,746	684,241	58,981,797	31,445	3,211,949
Incandescent, over 150 watt	14	83,058	32,078,931	80,052	30,479,369	3,006	1,599,562
Fluorescent, RF and F[1]	5	42,583	21,630,218	40,411	20,538,652	2,172	1,091,566
Germicidal	3	158	421,967	153	418,337	5	3,630
Photoflash	3	36,166	2,977,555	34,916	2,874,880	1,250	102,675
MINIATURE	14	334,438	21,776,959	314,694	20,799,188	19,744	977,771
Automotive, glass sealed beam	3	12,244	5,229,834	11,925	5,109,605	319	120,229
Other automotive	7	141,872	7,728,802	135,809	7,366,574	6,063	362,228
Miniature, other than automotive	14	180,322	8,818,323	166,960	8,323,009	13,362	495,314
MISCELLANEOUS	3	38,646	4,187,371	38,301	4,141,349	345	46,022
Christmas tree[2]	3	28,639	939,159	28,431	933,159	208	6,000
Electrical discharge[3]	3	10,007	3,248,212	9,870	3,208,190	137	40,022

[1]Does not include fluorescent Christmas tree on RP—12 "black light" but does include tubular, straight, and curved types.
[2]Includes fluorescent Christmas tree.
[3]Includes glow, sodium, RP—12 "black light", photo-chemical, mercury, and sun lamps.

Attention . . .

Glass Tank Operators

For Maximum Life SPECIFY

C · S · R

CAST SUPER REFRACTORY

For

Mantels, Feeder Parts, Tuckstones, Burner Blocks, Port Covers, Port Bottoms, Port Arches, Port Skews, Port Baffles, Lintels, Jambs, Bridgewall Covers, etc.

C.S.R. ***has excellent resistance to***

HIGH TEMPERATURES
CORROSION
SHRINKAGE
SPALLING

C.S.R. ***is***

VACUUM CAST
ACCURATE TO SIZE
UNIFORM TEXTURE
ECONOMICAL

●

Write for Full Particulars

WALSH REFRACTORIES CORP.

High Grade Refractories for Over 50 Years

4070 NORTH FIRST STREET ST. LOUIS 7, MISSOURI

CURRENT STATISTICAL POSITION OF GLASS . . .

(*Continued from page* 248)

ments and inventories of glass containers for March 1946 are the highest reported since the first of the year.

Plate glass production for March 1946 was reported to be 19,292,306 sq. ft., according to the Hughes Statistical Bureau. This figure indicates a considerable increase —about 39 per cent—over the production of 13,849,437 sq. ft. during February. March 1945 plate glass production was reported to be 8,996,095 sq. ft. which is also considerably below March of this year. Total production for the first quarter of 1946 is 37,497,034 sq. ft. as compared with 25,274,180 sq. ft. produced during the same period last year.

Automatic tumbler production for the month of March 1946 totalled 7,769,565 dozens, which is an approximate 20 per cent increase over February. Production in February was 6,465,397 dozens. March 1945, reported at 6,033,965 dozens, was about 29 per cent below March this year. Shipments during March 1946 were 7,671,675, or 25 per cent above the February shipments of 6,137,939 dozens. March 1945 figures indicated shipments totalling 5,394,657 dozens—an approximate 42 per cent below March 1946. Inventories at the end of March 1946 were 5,006,745 dozens in comparison with 5,394,657 dozens at the end of February.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware for the month of March 1946 were about 13 per cent above the February total. March sales were 4,153,380 dozens and February sales were 3,681,302. The March figure also indicates a considerable rise—about 31 per cent—over March 1945 which was 3,172,582 dozens. Total sales during the 12-month period ending March 1946 were 39,315,534 dozens.

WICKWIRE SPENCER NAMES CLIFTON SUPERINTENDENT

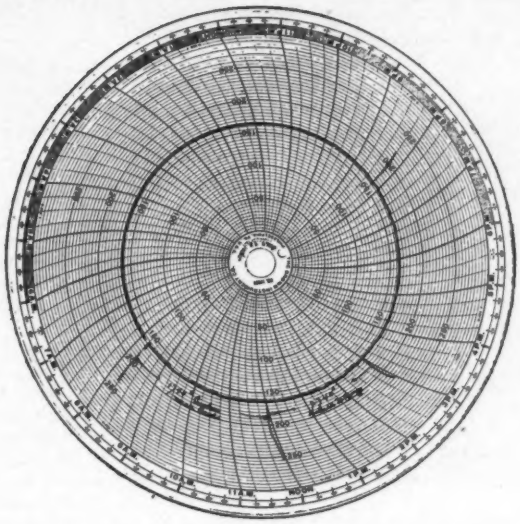
According to a recent announcement by the Wickwire Spencer Steel Company, it was revealed that D. A. Sutch has been appointed General Superintendent of the company's Clifton plant.

Mr. Sutch succeeds G. G. Lloyd who was recently transferred to the Buffalo plant as general superintendent. Prior to his new assignment, Mr. Sutch has been Works Manager of the Wickwire Spencer Aviation Corporation, a subsidiary of the Colorado Fuel and Iron Corporation.

● According to the current Military Government report issued by the War Department on conditions of industry in Germany, production of glass has declined in the last month, primarily because of the shortage of soda ash. The only source of this material in the U. S. Zone is the plant at Heilbronn. Production at this plant has dropped off because of shortages of coal. The possibility of obtaining soda ash from the French Zone is being investigated.

One of the many advantages

of **GAS** and **MODERN GAS EQUIPMENT**



precise,

easy

and inexpensive

controllability

No other fuel for the industrial production line, where heat application in any form is required, lends itself so well to control of combustion and temperature as does Gas. The rate of flow, which determines heat input, may be varied over wide limits, at an infinite number of intermediate points.

This extremely accurate control of Gas has contributed considerably to improvements in Glass and Ceramics manufacture and the creation of better products. In annealing and decorating lehrs, in special process furnaces, in convexing and bending furnaces, for preheating, for batch or continuous operation, Gas control provides a fidelity to exactness that is unequalled in heat treating.

Gas controllability is, at the same time, very easy to obtain with equipment that is far less expensive to install and operate. This fuel knows no mere "on," "off" or "in-between" control, but, instead, close, accurate modulation to best serve industry. The local Gas Company's Industrial Engineer will, without obligation, advise how Gas and modern Gas equipment can bring their dual advantages to work for industry.

AMERICAN GAS ASSOCIATION

420 LEXINGTON AVENUE, NEW YORK 17, N.Y.

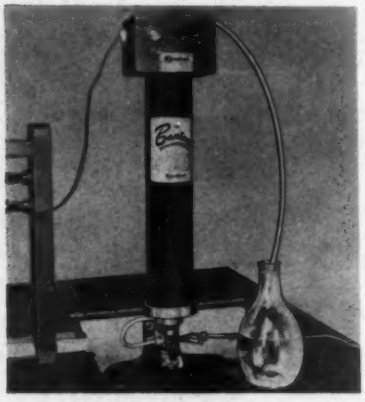
THE TREND IS TO GAS

FOR ALL CERAMIC FIRING

NEW EQUIPMENT AND SUPPLIES

BANTAM DEMINERALIZER INTRODUCED

The Barnstead Still & Sterilizer Company, Lanesville Terrace, Forest Hills, Long Island, N. Y., has introduced their new Bantam Demineralizer. It employs a single renewable cartridge which contains both cation and anion resins, which convert the dissolved salts in



the water to their corresponding acids, and then chemically absorb these acids.

No heat, electricity or chemicals are employed in the process and flowrate is from 5 to 15 gallons per hour. The Bantam can be connected to water supply by rubber tubing or ¼" pipe. It is then only necessary to turn on water supply and collect demineralized water in continuous flow.

It is claimed that one cartridge will remove 400 to 600 grains of ionizable salts. Therefore, one cartridge will produce up to 300 gallons of demineralized water, depending upon the hardness of the raw water supply. When resistance of effluence drops to 50,000 ohms, the indicator lamp goes out showing that a new cartridge is needed. To replace the cartridge, it is merely necessary to loosen thumb-screw which holds it in place and insert new cartridge. It is this disposable cartridge feature which makes the apparatus practical for the small user of de-ionized water.

NEW TEMPERATURE REGULATOR

Washington Glass Laboratory and Instrument Company, 3224 Georgia Avenue, N.W., Washington 11, D.C., has developed a new mercury temperature regulator with signal light, either red or white, which glows brilliantly while temperature is rising and shuts off when setting temperature is reached. The signal light can be seen at a distance when glowing so that the operator can perform other duties.

Called the Mercuroplat Thermoregulator, the new device is intended for accurate control of temperature in water, oil or air baths, ovens; at any temperature within the setting range from 30°F. to plus 500°. It has a sensitivity of plus or minus 0.02°F. or better. The thermoregulator is available in 6, 8, 10 or 12 inch lengths.

TOLEDO ENGINEERING ANNOUNCES LEHR IMPROVEMENTS

Design and construction of Teco lehrs include use of heat-resisting steel, long life belts, natural ventilation with no fan and motor upkeep and they retain the Firoll system.

Flexible in operation, Teco Firoll lehr front designs vary depending upon means employed to place glassware in the lehr. The company's pusher type stackers are standard equipment. However, any automatic or hand stacker can be used. Sides and bottoms are built in steel encased sections the entire length, and heavy channels and angles reinforce side and bottom plates. The lehr casing is well insulated and the fire box roof incorporates insulation refractory in arch form and is plaster coated to prevent roof leakage.

Adjustable drive end assures alignment with the main section. Low fire box maintenance and longer belt life is afforded. Heat is evenly and properly distributed. Thermocouple temperature indication is afforded the full length of the lehr.

Wire mesh ware carrying belt is supported on free turning lubricated ball bearing mounted rollers, except directly over drive unit. All bearings are easily lubricated. Natural ventilation is utilized. Two pivoted vents located in the lehr top beyond the fire box provide means to control the annealing cycle in conjunction with two adjustable dampers located below the belt. These dampers establish heat zones beyond the fire box. Pivoted louvers open to circulate free air and cool ware approaching lehr discharge end.

Teco Firoll Lehrs are designed to burn natural gas, artificial gas, propane or bottled gas, or washed producer gas. Teco Firoll Decorating Lehrs using gaseous fuel are also available.

WHEELCO DEVELOPS PYROMETER CONTROLLER

The Wheelco Instruments Company, 847 W. Harrison Street, Chicago, Illinois, has announced the recent development of the Wheelco Multronic Capacitrol, a multi-position electronic pyrometer controller.

The Multronic Capacitrol is a new development of the Wheelco electronic control principle and adds further flexibility to meet a wide range of applications requiring instantaneous, accurate indication and control of temperature, voltage, current, signalling and similar variables in process industries.

The new device provides on-off control at one or two different points, control of two separate fuel systems on a single pot or other heat-treating type furnace, automatic positioning control for electric, oil and gas-fired equipment, on-off control plus automatic fuel shut-off or multi-signalling at two points or two signals at dual points.

Two electronic control circuits operate in harmony with each other, but independently, to control the variables as measured by an accurate indicator providing instantaneous control action.

CATALOGUES RECEIVED

Pennsylvania State College, School of Mineral Industries, State College, Pa., has recently announced the publication of "Circular 20, Opportunities for Productive Work through Mineral Industries Research".

The catalogue covers such phases of the program as Organization of the Mineral Industries Experiment Station, Routine Testing, Research Program, Cooperative Research, Cooperation with Other State Departments, Earth Sciences, Mineral Engineering and Mineral Technology.

Dow Corning Corporation, Midland, Michigan, has issued a booklet, "Silastic Facts No. 1A" which contains information about some of the established uses for Silastic.

Included are tables giving the physical and electrical properties and the chemical resistance of the six Silastic stocks now available in commercial quantities.

Precision Equipment Company, 32 N. State Street, Chicago 2, Illinois, has published its new Spring-Summer edition pointed to all factory superintendents, maintenance engineers, purchasing agents and other plant executives.

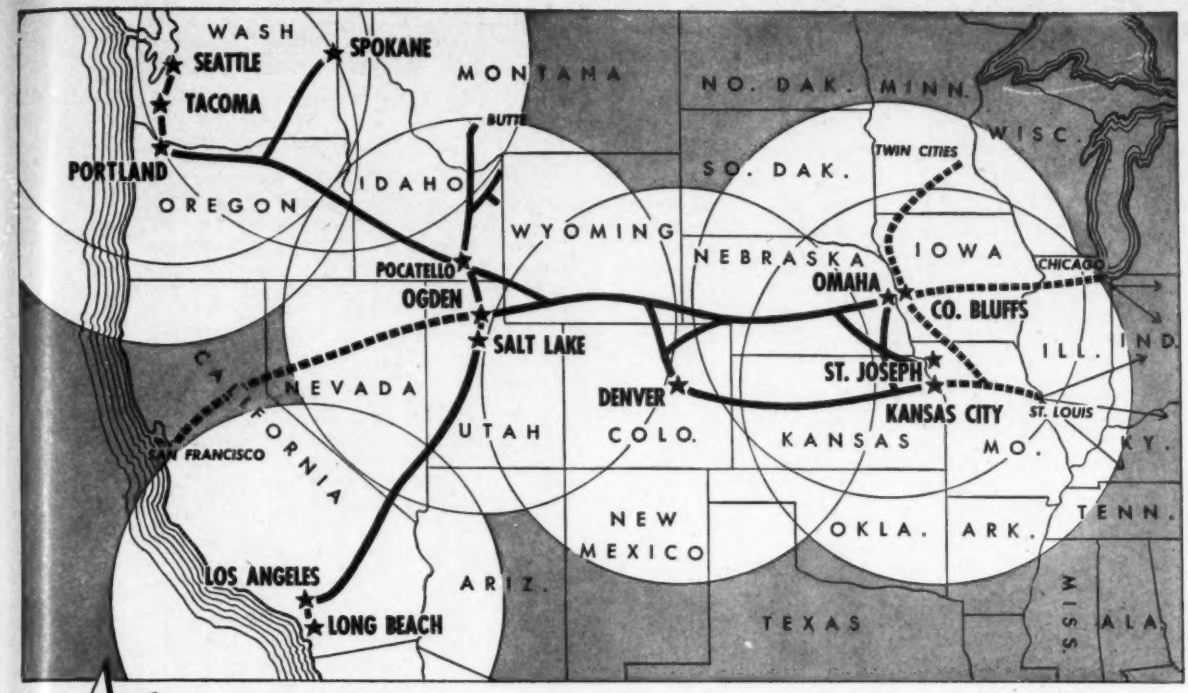
The catalogue contains listings on a complete line of mill supplies, as well as fans, steel shelving, lockers, electric tools, filing cabinets, etc.

The Smith & Mills Company, 2938 Spring Grove Avenue, Cincinnati 25, Ohio, has recently issued a 24-page catalogue, "Catalogue 45", which contains data, illustrations, drawings and specifications regarding the Smith & Mills 12", 16", 20", 25", 28" and 32" crank shapers.

The booklet contains operating instructions for tool head, ram, rocker arm block, clutch lever, feed change, etc.

Fischer & Porter Company, Department #9M-3, Hatboro, Pa., has issued a new bulletin, 55-A, describing in detail pneumatic transmitting accessories which may be applied to any Rotameter type flow rate instrument.

The booklet contains illustrations throughout and includes engineering data on Fischer & Porter pneumatic positioners.



Opportunity for Industry

The western territory served by Union Pacific is rich in countless raw materials required by industry; has power and other necessary facilities; has a high type of native-born labor. Here lies the opportunity for industry to build and expand.

Among the principal industrial tracts owned or served by Union Pacific are those located in, or near by, the following cities:

Omaha, Neb.	Ogden, Utah
Council Bluffs, Iowa	Portland, Oregon
St. Joseph, Mo.	Seattle, Wash.
Kansas City, Mo.-Kans. (Fairfax District)	Tacoma, Wash.
Denver, Colo.	Spokane, Wash.
Salt Lake City, Utah	Los Angeles, Cal.
	Long Beach, Cal.

As the map shows, all these cities are located on the main lines of the Union Pacific Railroad.

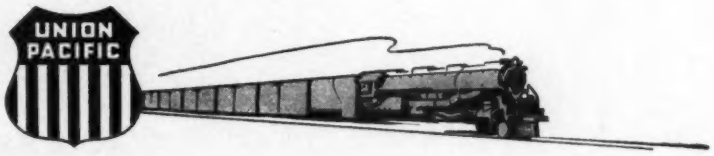
The circles on the map indicate 500-mile distribution areas. In normal times, Union Pacific operates a fast, merchandise freight (L. C. L.) service within these short-haul areas, with door-to-door pick up and delivery service.

These industrial properties are improved and occupied by many diversified manufacturing and commercial enterprises.

Necessary utilities are available and each tract is served by adequate industrial trackage. Whenever required, additional trackage can be provided.

You are cordially invited to write W. H. HULSIZER, General Manager of Properties, Union Pacific Railroad, Omaha 2, Nebraska, regarding industrial districts in territory served by Union Pacific.

be Specific – say "Union Pacific"



The Progressive

UNION PACIFIC RAILROAD

The Strategic Middle Route

VALUE OF UNITED STATES EXPORTS OF GLASS CONTAINERS TO SELECTED MAJOR COUNTRIES*
1939 TO 1945
(DOLLARS)

Country	1939	1940	1941	1942	1943	1944	1945
BEVERAGE BOTTLES							
Canada	343,312	419,944	742,385	1,323,314	650,020	1,150,274	1,506,465
Cuba	400,182	410,739	819,990	985,364	1,551,099	2,018,092	1,374,106
Colombia	108,949	195,182	243,038	90,094	107,242	298,838	350,845
Jamaica	51,330	35,787	81,655	71,910	162,211	227,245	147,692
Panama, Republic of	44,786	174,962	332,577	385,560	285,584	190,519	107,255
Philippine Islands	75,739	66,640	73,859	—	—	—	5,854
Venezuela	69,424	265,724	253,410	112,746	53,161	160,518	238,425
Dominican Republic	38,476	30,795	68,550	87,445	103,551	130,782	158,864
Belgian Congo	—	36,456	232,163	114,204	43,708	67,813	105,444
Union of South Africa	19,404	67,804	196,006	8,387	33,309	290	54,258
Mexico	26,315	31,912	74,051	80,087	288,617	1,452,143	2,068,887
Guatemala	22,187	38,159	31,267	39,706	40,428	66,654	112,898
Ecuador	12,850	15,546	29,151	28,352	24,580	39,870	74,338
Costa Rica	4,954	24,249	60,070	11,848	60,420	55,266	32,055
Trinidad and Tobago	3,190	55	9,576	30,766	29,400	40,622	56,286
PHARMACEUTICAL AND PROPRIETARY WARE							
Canada	203,754	208,291	169,686	173,116	206,805	385,575	435,551
Cuba	252,441	295,383	340,704	507,610	341,847	502,062	489,564
Colombia	127,184	141,345	207,607	182,966	203,936	262,489	288,504
Venezuela	78,149	141,079	178,716	104,843	158,279	179,260	230,615
Philippine Islands	27,468	35,565	41,200	—	—	—	4,520
Union of South Africa	39,411	51,275	76,608	42,833	41,488	53,888	149,598
Mexico	46,594	90,406	185,164	266,601	138,700	209,225	282,296
Brazil	15,764	72,245	78,766	20,478	18,546	65,186	197,837
Dominican Republic	15,201	10,033	11,429	19,311	14,002	24,878	18,411
Panama, Republic of	8,344	15,041	14,693	36,420	20,726	24,306	23,546
Peru	11,694	15,262	38,834	40,541	40,809	36,341	26,157
Ecuador	2,809	13,028	15,349	13,111	12,685	17,908	29,240
Costa Rica	10,568	23,601	21,485	12,507	11,223	17,943	43,645
Guatemala	5,827	13,875	11,994	8,657	11,325	17,287	26,146
Honduras	5,679	5,561	23,483	12,159	10,603	8,878	14,092
OTHER GLASS CONTAINERS							
Canada	391,707	316,980	160,755	207,412	118,888	279,630	586,270
Cuba	109,612	191,872	247,615	216,551	290,408	443,175	440,978
Colombia	72,032	78,340	86,937	31,571	—	52,854	6,571
Jamaica	15,832	5,037	3,685	3,242	12,385	26,034	22,277
Mexico	28,305	44,321	73,090	79,890	141,603	175,268	190,423
Philippine Islands	58,583	38,572	81,642	—	—	—	37,020
Panama, Republic of	17,700	21,705	18,060	5,307	5,565	8,488	15,371
Guatemala	8,224	6,400	7,734	4,074	14,988	9,205	12,389
Venezuela	43,915	114,148	74,764	31,393	14,499	78,269	127,672
Peru	11,491	14,757	12,532	9,570	9,860	11,832	21,683
Chile	4,281	23,188	26,137	14,104	11,046	13,353	43,957
Union of South Africa	220,650	205,774	198,618	14,615	6,041	114,114	372,409
Newfoundland and Labrador	11,731	12,800	8,376	15,413	7,018	31,483	13,913
Costa Rica	15,408	15,936	10,755	3,147	9,053	6,276	17,877
Brazil	7,108	8,790	24,131	21,061	3,507	15,914	33,948

*Source: Department of Commerce.

TOTAL EXPORTS OF GLASS CONTAINERS TO EUROPE*
(Including Iceland and Azores)
DOLLAR VALUE

Period	Total Exports	Pharmaceutical and Proprietary Ware	Beverage Bottles	Other Glass Containers
1939	55,963	16,416	3,899	35,648
1940	21,523	12,701	1,985	6,837
1941	47,475	43,199	2,517	1,759
1942	30,529	26,313	924	3,292
1943	17,182	9,425	1,563	6,194
1944	64,211	15,146	14	49,051
1945	219,329	103,567	83,817	31,945

*Source: Foreign Commerce and Navigation, Department of Commerce.

Our post-war markets in countries below the Mexican border will be primarily dependent upon the maintenance of a high degree of spending power. For the immediate future, the American exporter of glass containers need have little fear from European competition but such competition will again be forthcoming as soon as our competitors are able to re-establish their domestic manufacturing facilities.

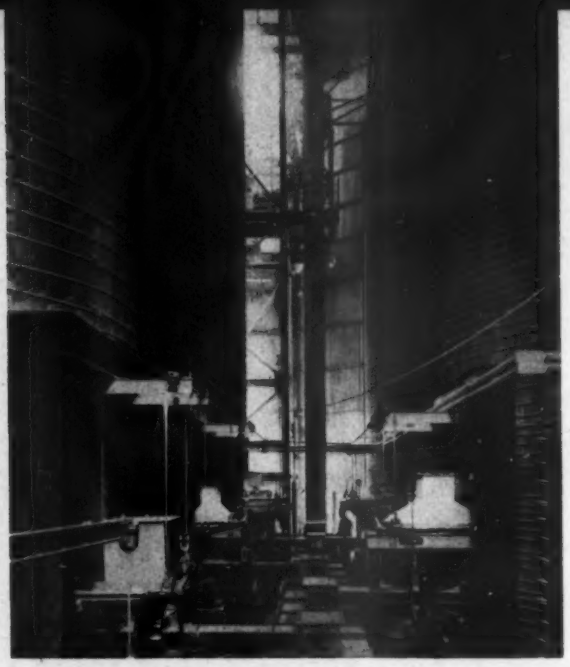
• The OPA has recently announced the removal of price control from glass replacement parts for safety goggles, welding shields and other protective equipment, marine glassware and glassware used for transportation equipment.

IF deliveries are not coming through as fast as you would like to have them, we would like to present the artist's view and say "Don't sweat, we're doing the best we can!" We are trying our best to furnish the same prompt delivery service that has been available to SOLVAY customers for years, but in spite of all our efforts, current demands have kept ahead of production. We appreciate the friendly cooperation of loyal SOLVAY customers and we hope that it will not be long before [illegible] for early deliveries will no longer be necessary.

SOLVAY SALES CORPORATION

40 Rector Street · New York 6, N. Y.

SOLVAY
TRADE MARK REG. U. S. PAT. OFF.



Corridor between the two rows of silos. At the far end of the gathering conveyor is the elevator which empties the weighed batch into the surge hopper and then into the mixer mounted 34 feet above floor.

FOSTER-FORBES BATCH HANDLING . . .
(*Continued from page* 236)

for his batches and the tank teaser on the No. 2 tank mixes his own batch.

The procedure for handling the batch and cullet for Plant 1 is this—the truckdriver ordinarily carries four cans of batch on his truck and usually brings back no more than two cans loaded with cullet. He backs his truck into the batch plant and locates the cans under the chute from the flop gate. As soon as he gets out of the truck cab he goes into the control room, sets the counter for the number of batches he desires to be mixed, then

Crane and can storage platform at Plant 1. Batch truck backs into notch in wall to unload cans. Both the truckdriver and the tank man walk on top of the cans while handling the cans.

presses the button that starts the cycle for his batch. Pressing the button to start this cycle starts the motor generator set that furnishes the power for operating the vibrating feeders. The mixer, elevator and conveyors start to operate and the vibrating feeders begin to fill the weigh hoppers with materials required for this batch. As soon as the correct weight of material is in the weigh hopper the vibrating feeder for that weigh hopper stops automatically. When all the weigh hoppers are filled to the correct weight they all start to discharge simultaneously onto the gathering conveyor and by means of a rheostat it is possible to regulate the discharge feeder so that they all empty at practically the same time. During this time the decolorizer unit has indexed allowing the barytes, saltcake, decolorizer, etc. to be dumped onto the gathering belt. After a sufficient time has elapsed for the tail end of the material to get down the conveyor,

Track hopper is located on a down grade. Practically all the cars are set over hopper by the unloader just loosening the brake of a car and allowing it to coast downgrade. By means of the hand brake he can position the car quite exactly. A car puller is located just on left edge of picture, but is rarely used.

up the elevator, and into a surge hopper the gate on the surge hopper, operated by an air cylinder, opens and allows the complete batch to be dumped into the mixer. After mixing for a predetermined time the mixer dumps the batch into the flop gate and down a movable chute into the can setting on the truck. This cycle takes approximately five minutes. The mixed batch weighs 5000 lbs. The truckdriver after setting the batch plant into operation goes over and weighs out the barytes and saltcake and dumps this and a jar of decolorizer for each batch into his decolorizer unit for his four batches, then goes around and climbs up onto the top of the cans on the truck and places the movable chute into one of the empty cans. After that can is filled he moves the chute into the next can, and so on until all four cans are filled. While waiting for the first and second cans to be filled with batch he picks his cans of cullet up with an electric hoist and runs them over a hopper where he dumps the

(*Continued on page* 262)

DON'T LET "COLOR THUGS" PUSH YOU AROUND!

● Color problems are tough thugs that must be handled with plenty of know-how if rejects are to be kept at a minimum and profits are to be saved.

And it is a wealth of practical know-how about colors and coloring chemicals that Drakenfeld offers you. Through the years, we have produced countless new colors, matched countless others, recommended many a practical production improvement, and thereby helped ceramic and glass manufacturers to wipe out needless waste in materials, time and effort.

Why let "color thugs" push *you* around—when you can have practical money-saving cooperation on colors and their application? Begin now to cut costs and increase production. Learn all about Drakenfeld's helpful service.

Write today.

DEPENDABLE SERVICE ON: Acid, Alkali and Sulphide Resistant Glass Colors and Enamels . . . Crystal Ices . . . Squeegee and Printing Oils . . . Spraying and Banding Mediums . . . Glassmakers' Chemicals . . . Glass Decolorizers . . . Decorating Supplies.

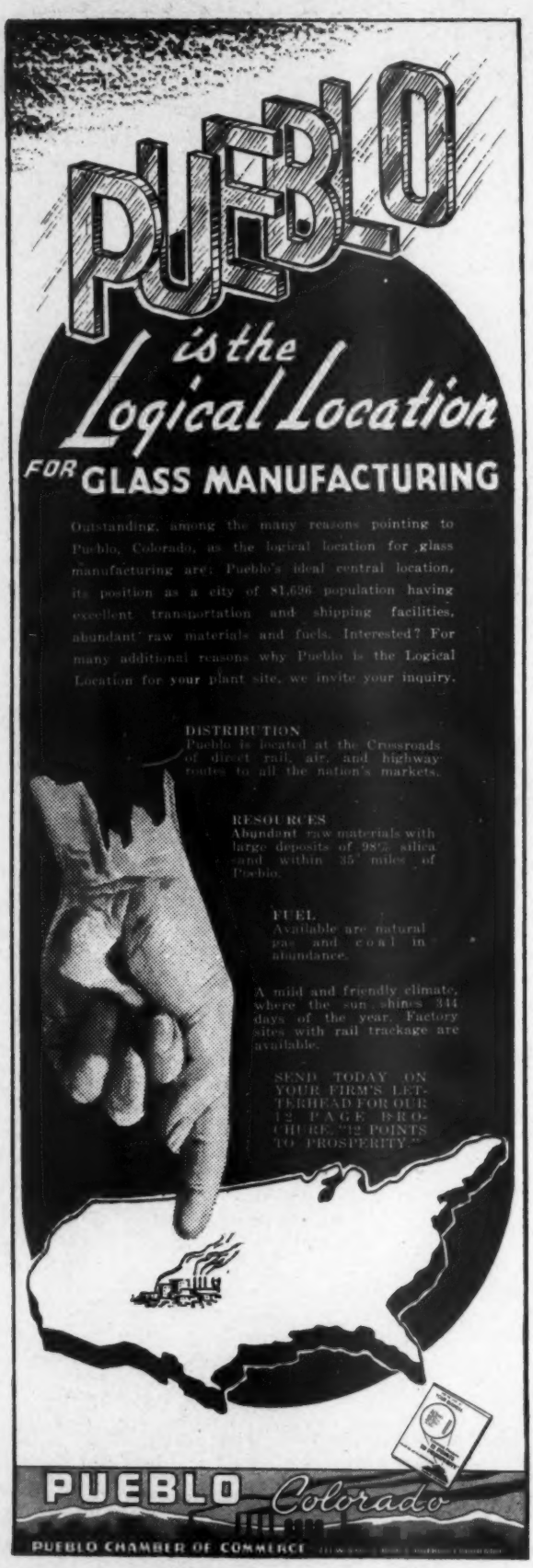
Drakenfeld

YOUR PARTNER IN SOLVING COLOR PROBLEMS

B. F. DRAKENFELD & Co., Inc. 45-47 Park Place, New York 7, N. Y.

Factory and Laboratories: Washington, Pa.

Pacific Coast Agents: Braun Corp., Los Angeles 21 . . . Berger-Knecht-Heimann Co., San Francisco 19


PUEBLO
is the
Logical Location
FOR GLASS MANUFACTURING
Outstanding, among the many reasons pointing to Pueblo, Colorado, as the logical location for glass manufacturing are: Pueblo's ideal central location, its position as a city of 81,626 population having excellent transportation and shipping facilities, abundant raw materials and fuels. Interested? For many additional reasons why Pueblo is the Logical Location for your plant site, we invite your inquiry.
DISTRIBUTION
Pueblo is located at the Crossroads of direct rail, air, and highway routes to all the nation's markets.
RESOURCES
Abundant raw materials with large deposits of 98% silica sand within 35 miles of Pueblo.
FUEL
Available are natural gas and coal in abundance.
A mild and friendly climate, where the sun shines 344 days of the year. Factory sites with rail trackage are available.
SEND TODAY ON YOUR FIRM'S LETTERHEAD FOR OUR 12 PAGE BROCHURE "12 POINTS TO PROSPERITY"
PUEBLO Colorado
PUEBLO CHAMBER OF COMMERCE

W. V. FISHER DISCUSSES INSTITUTE OF GLASS TECHNOLOGY

A meeting of the Board of Trustees of the Institute of Glass Technology was held in New York on February 22, 1946, to discuss the present situation and to outline the corporate policy in the immediate future.

The Institute was incorporated late in 1943 following a survey report of the Institute Committee of Glass Container Manufacturers composed of Messrs. Royden A. Blunt, George Lang, Joseph C. Feagley, Hugh C. Laughlin, Francis H. May, the late John H. Rau, and R. L. Warren. The report, it will be remembered, recommended the establishment of an educational institution to train men at the graduate level technically for the glass industry in combination with a laboratory to conduct fundamental and applied research investigations of direct interest to the glass industry. It was expected that in such an institution necessary research and development could be prosecuted and the interests of the industry promoted.

William V. Fisher, Chairman of the Board of Trustees, in discussing the plan said, "No one can question the fact that our industry is desperately in need of scientifically trained manpower to help us pursue and solve our technical problems. The opportunity that lies before our industry in the form of needed development and the number of technical problems in every department of our business which urgently claim solution is boundless. Raw materials, process, manufacturing equipment evaluation, shipping, and end uses all demand scientific and technical study. It seems to me that now is the most appropriate time to prepare while we can to meet the pressing problems of the future."

A comprehensive plan for the establishment of the proposed institution had been prepared. The plan required the interest and support of the majority of the container manufacturing companies in order that its effectiveness might be assured. After discussion with the industry's leaders, it was decided that the plan should not be immediately put into operation, but that temporarily the program should be held in abeyance until some of the more currently critical industry problems have been resolved. "The Institute of Glass Technology both as to corporate structure and ideal are not to be abandoned. It is my personal opinion, which I am sure is shared by my fellow trustees, that this is a program of prime importance to the future development of our whole industry. My judgment is supported by the demonstrated experience of other industries which have provided themselves with similar facilities. It is interesting to note that some of the progress made in one of our competitive industries draws its origin from such an institution as we are discussing." Mr. Fisher said, "The corporate funds are being preserved to provide a nucleus with which to launch the program at an appropriate time."

• Lionel R. Barrett, who received a Master of Science degree in 1937 in Ceramic Engineering at the University of Illinois, has been appointed Lecturer in Refractories at the Imperial College in London, England. After his graduation and until his recent appointment, Dr. Barrett has been associated with the Mellor Laboratories.

Even if your plant is small and you cannot afford costly equipment, Cleveland Tramrail can solve your batch segregation problem.

Simple, inexpensive, hand-propelled equipment is available that admirably handles the needs of smaller glass plants. Segregation is eliminated just as completely as with the more elaborate systems in large plants. While hand-propelled systems are slower, they are smooth and easy in operation and easily take care of the requirements of smaller plants.

The trend is to higher quality, more uniform glass. If you, too, are working toward this goal, it will pay you to investigate what Cleveland Tramrail has to offer.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
1161 East 283rd St. Wickliffe, Ohio

GET THIS BOOK!

BOOKLET No. 2009 . . . Describes glass plants using Cleveland Tramrail. Contains engineering data and information valuable to glass producers. Write for free copy

CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT

METALLURGICAL ASPECTS OF X-RAY TUBE MANUFACTURE . . .

(*Continued from page* 241)

Kovar and the nickel-iron alloy represented by Nickelex. In the case of the former alloy the composition is approximately 54 per cent iron, 30 per cent nickel, and 16 per cent cobalt; the latter alloy contains approximately 42 per cent nickel, remainder iron plus small percentages of manganese and carbon.

After forming and machining, the sleeves are heated in the hydrogen furnace for a short time to remove strains and to prepare the surface for application of the wetting glass. The hydrogen furnace treatment decarburizes the surface as well as cleans it. The sleeves are then ready to be oxidized in an open flame and wetting glass is applied before allowing them to cool. The oxide film is necessary for the formation of a vacuum tight bond between the glass and the metal sleeve. The oxide film actually goes into solution with the glass, thus forming a chemical bond. Figure 10 shows typical sleeves before and after application of the wetting glass.

The sleeves with the wetting glass applied are then silver soldered to the copper anode generally with eutectic silver-copper alloy (72 per cent silver, 28 per cent copper) either in air or a vacuum furnace. Whenever the sleeve is used at the cathode end of the tube, it is generally copper brazed to a steel header prior to application of the wetting glass.

Careful control of all processing is necessary in preparing glass to metal seals. The low expansion alloys must meet specifications as to chemical composition and thermal expansion. Preliminary processing tests of each lot are generally made before materials are accepted for production use.

After sleeves have been soldered or brazed to the cathode or anode assemblies, a glass envelope is sealed to the wetting glass of the two sleeves on a glass working lathe as shown in Figure 11.

Fig. 11—Glass-working lathe—this size used for building tube shown in Fig. 4.

Exhausting X-Ray Tubes

The completed tube is exhausted in equipment as shown in Figure 12. The tube is sealed to the pumping system through a glass constriction. The pumping system consists of a special mercury diffusion pump backed up by a mechanical pump of standard make. Oil diffusion pumps are also used. However, mercury pumps have been shown to be more rugged and foolproof. The choice of diffusion pumps in most cases depends on the availability and price of liquid air which is necessary for proper operation of the mercury diffusion pump. After preliminary exhaust the tube is baked out at 450°C in a gas furnace, the back and side walls of which can be seen in Figure 12. This operation is necessary to expel gases adsorbed on the inner wall of the glass envelope. The anode and cathode are then individually degassed by heating to a dull red heat by means of a high frequency induction coil. And, finally the anode is bombarded; that is, the tube is actually operated at this point until free of gas. Of course, during all of these operations the tube is being continually outgassed by the pumping system and pressures are closely watched by means of an ionization gauge attached to the exhaust system. The ionization gauge is connected directly to a microammeter which indicates pressure in microns (0.001 millimeter). The tube is considered exhausted only when pressures are on the order of 0.1 micron. All of the above operations require from six to forty-eight hours, depending upon type and size of the tube. The tube is finally sealed off by collapsing the constriction under heat.

Fig. 12—Exhaust equipment for outgassing x-ray tubes.

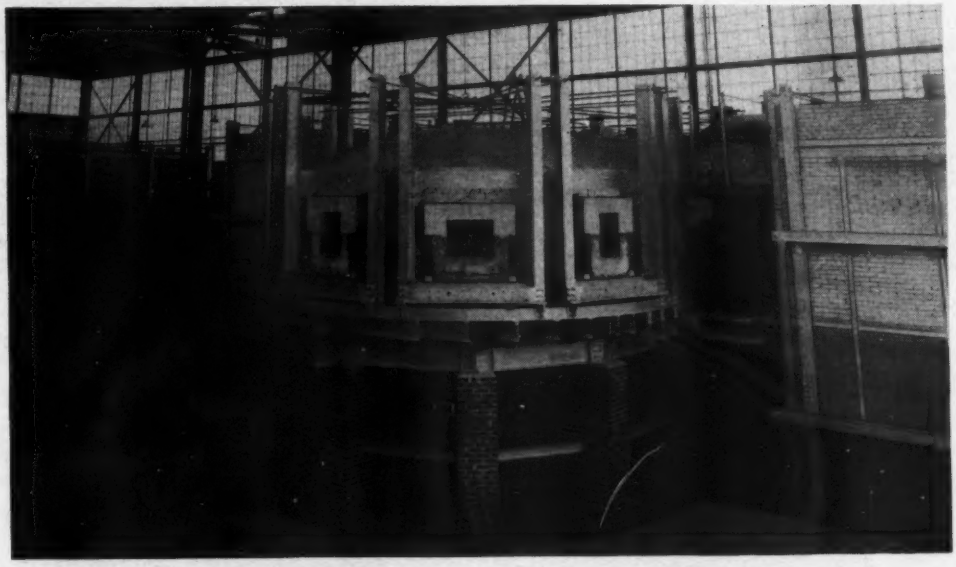
BIBLIOGRAPHY

1. Research Laboratory, General Electric Company, "X-Ray Studies," 1919.
2. F. R. Abbott, "Transient Temperatures in the Anode of an X-Ray Tube," J. App. Phys. 13, 384 (1942).
3. H. C. Steiner, "Glass in Electronic Tubes," Bull. Amer. Ceram. Soc. 24, 56 (1945).
4. A. W. Hull, E. E. Burger, and L. Navias, "Glass-to-Metal Seals, II," J. App. Phys. 12, 698 (1941).
5. H. Brackney and Z. J. Atlee, "Beryllium Windows for Permanently Evacuated X-Ray Tubes," Rev. Sci. Inst. 14, 59 (1943).
6. Z. J. Atlee, "Beryllium Windows," G.E. Review 46, 233 (1943).
7. Z. J. Atlee, "Diffraction of X-Rays," Radio-Electronic Engr., June, 1944.
8. F. C. Kelley, "Sintered Beryllium for X-Ray Tube Windows," Iron Age, July 26, 1945.
9. Z. J. Atlee, "Industrial X-Ray Tubes," Electronics, November, 1945.
10. K. Rose, "Vacuum Casting of Electronic Parts," Metals and Alloys 21, 1324 (1945).
11. Z. J. Atlee, J. T. Wilson and F. C. Filmer, "Lubrication in Vacuum by Vaporized Thin Metallic Films," J. App. Phys. 11, 611 (1940).

• The Verna Art Glass Company has acquired the former Zenith Art Glass Company property in Millville, New Jersey.

Designing Constructing Operating

TO THE GLASS INDUSTRY



Patented Underfired Tank Furnace

Assures Close Control over Melting

The illustrated underfired tank furnace shown during construction, embodies modern design with sound construction. Numerous, exclusive patents insure steady, uninterrupted performance, select quality glass and greater facility in operation. These advantages provide increased production with consistently lower fuel costs.

The regenerators are constructed with vertical partitions creating individual regenerators for each port. Each of these "divisional regenerators" has its own checkerwork and flue dampers. This permits individual control of each regenerator compartment. When cleaning or repairs are necessary, one or more of these individual compartments may be cut out without interfering with furnace operation. The patented port design insures excellent combustion and permits great facility in port repairs.

Automatic controls from stack dampers to ports guarantee close control over the melting process. Provisions for manual control throughout the furnace operation are included

For complete details concerning this furnace or for information regarding any of our services to the glass industry contact us today. We welcome inquiries.

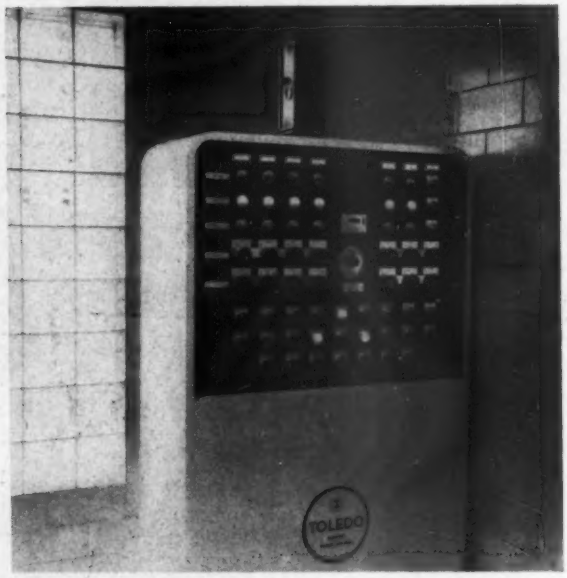
FORTER-TEICHMANN *company*

610 Smithfield Street **Pittsburgh, Penna.**

Cable "FORTER" *Associate of Forter-Teichmann International* **Phone GRant 1302**

FOSTER-FORBES BATCH HANDLING . . .
(*Continued from page* 256)

cullet by opening the gate in the bottom of the can. The truckdriver does not need to push any more buttons after he has once started the cycle, for the weigh hoppers are filled automatically as soon as they have been discharged completely until all the batches that are desired have been weighed out. If the truckdriver so wishes he can set the control counter to weigh anywhere from one to sixty batches at a time. After the last batch has been discharged the scale hoppers remain empty, for the batch for No. 2 Plant may receive different amounts of materials than the batch for No. 1 Plant. After the truck is loaded the driver takes it to Plant 1 where he picks up each can with a crane and sets it on a concrete platform, that is large enough to accommodate cans for eighteen hours operation. He then picks up an empty can, or a can of cullet, and sets it on the truck where the full one had been and so continues until all cans of batch are unloaded and set on the platform and he has a truckload



The central control panel housed in a separate building. By means of signal it indicates the progression of the cycle. Here also are the control buttons that operate the tramrail equipment. Inside the cabinet is an imposing area of timers and relays that control the entire cycle.

of empty cans or perhaps a can or two of cullet with the rest empty.

When a can of batch is needed by the tank teaser he uses the crane to hoist the can up to where it will clear all obstructions. When he presses the forward button on the crane control the carrier that contains the hoist runs off the crane onto a monorail that passes over the doghouse hopper. The carrier stops automatically over the hopper where the can of batch is emptied by the tank teaser. He then presses a button, which runs it back onto the crane. In order to fill a can with cullet it is lowered through an opening in the tank platform into a pit in the basement floor and into which cullet from either the tank basement or the packing room is dumped, and when that can is filled with cullet it is hoisted out and set on a platform and an empty can put in its place.

The batch for No. 2 tank is carried from the mixer to the hopper over the doghouse in a single can drawn by an electric tractor. These travel on a monorail located 29 feet above the floor level. The tank man can control the tractor either from the central control panel in the batch plant or from a small control panel on the doghouse platform. When he desires a batch he presses the button on the control panel at the tank that starts the weighing cycle for his batch. He starts the can back to the batch plant by means of another button. When the can reaches the batch plant it stops automatically just short of the proper position for filling. The tank man must position it exactly under the mixer by an inching button for it is very difficult to stop the can automatically at the same spot each and every time. When he has it correctly positioned a signal light on the control panel indicates that it is in place. When the can is filled with the mixed batch it returns automatically to the furnace room and stops over the doghouse hopper. The mixer can not dump the batch unless the can is in position to receive it.

The mixer, elevator, conveyor and M.G. set stop at the end of the cycle. The tank teaser need only to go out to the batch plant every four batches or approximately every two hours to fill the decolorizer unit.

The one can on the monorail does not allow for much batch storage to use when there is any breakdown or other difficulty in the batch plant. To provide for this emergency storage the old batch storage bin back of the doghouse was adapted so that it could be filled from the can on the monorail. This gave a twelve to eighteen hour supply of batch in case of trouble with the batch plant or electric tractor.

Cullet from No. 2 Packing Room and tank basement is dumped into a skip hopper and elevated by the same electric hoist as is used to remove the cans of cullet from the truck. This dumps into another hopper from which the cullet is fed by the electric vibrator into a pulverizer. After passing through the pulverizer it falls into a boot of continuous bucket elevator 75 feet high, which empties into the cullet silo. If foreign cullet were delivered in trucks it could be handled in the same manner and run into another bin.

Since it is necessary to have a tank teaser for each tank, the only men required to unload, mix and deliver the batch to the tanks is one man to unload the raw materials and a truckdriver to haul the cans of mixed batch to Plant 1. It formerly required five men to unload and nine men to mix, that is, when it was possible to get them.

The average quality of our glass, especially the homogeneity, has increased tremendously.

Those responsible for certain engineering and construction features and suppliers of equipment not mentioned in the preceding pages follow:

Concrete piling by Raymond Concrete Pile Company.
Slab and pits—Bowman Construction Company, Marion, Indiana.
All mechanical equipment and scales in batch plant—furnished and erected by Jeffrey Manufacturing Company.
The automatic and interlocking controls on the weighing and mixing cycle—designed and built by the Toledo Scale Company.
Air compressor—Ingersoll-Rand Company.
Tramrail equipment—Cleveland Tramrail Div. of Cleveland Crane (erected by Indiana Bridge Company, Muncie, Indiana).
Mixer tower building—Indiana Bridge Company.
Corrugated iron siding—Liniger Company, Marion, Indiana.
Concrete platform at Plant 1—Harreld Bros., Marion, Indiana.
Power wiring conduits and magnetic switches laid out and installed by Foster-Forbes Glass Company.
All control wiring installed by Foster-Forbes Glass Company.
Control room designed and erected by Foster-Forbes Glass Company.
Batch cans constructed by Superior Metal Products Company, Marion, Indiana.

SURFACE COMBUSTION

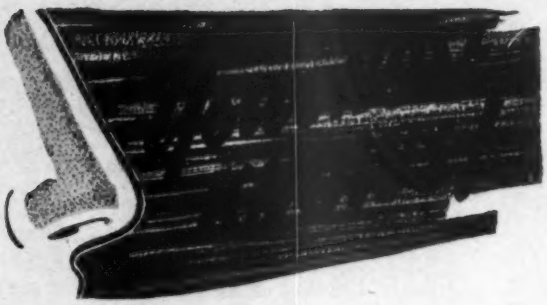
CONTINUOUS ANNEALING LEHRS

...heat more glassware faster

● Expensive production will not be a handicap to the progressive plant operator using Surface Combustion Continuous Conveyor Annealing Lehrs to meet future market demands for quality and quantity glassware at a reasonable cost. Exacting "zone control" of time-temperature plus recirculating or convection heating give uniform processing conditions that make for quality. Mass production lowers cost. Ask a Surface Combustion Engineer to discuss *all* the advantages of these modern lehrs... no obligation.

SURFACE COMBUSTION

TOLEDO 1, OHIO

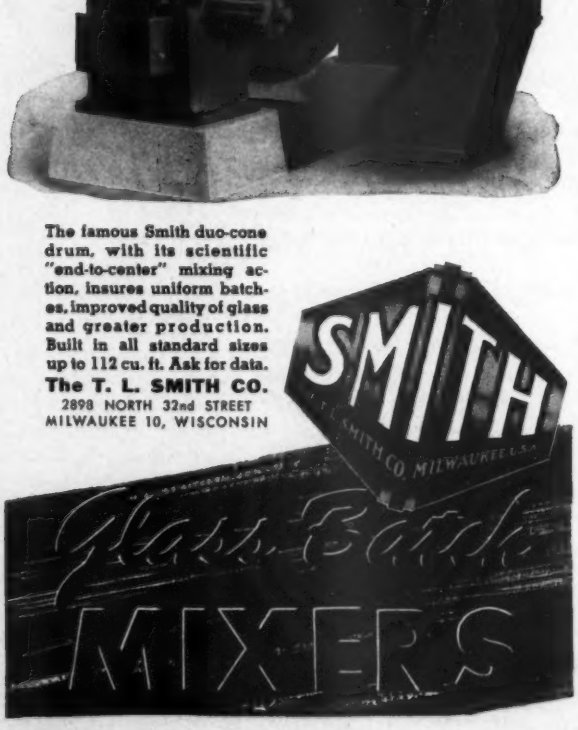


You breathe pure, dust-free air in a batch room equipped with Smith Mixers. That's because the Smith is *dust-sealed during the entire cycle of operations* — charging, mixing and discharging. There's no chance for dust or vapor to escape. Eliminates silicosis hazard. Promotes employee health and efficiency, at the same time producing quality glass batches in the shortest possible mixing period.

Mix Your Glass Batches in a DUST SEALED SMITH MIXER!

The famous Smith duo-cone drum, with its scientific "end-to-center" mixing action, insures uniform batches, improved quality of glass and greater production. Built in all standard sizes up to 112 cu. ft. Ask for data.

The T. L. SMITH CO.
2898 NORTH 32nd STREET
MILWAUKEE 10, WISCONSIN



INVENTIONS & INVENTORS . . .

(*Continued from page* 243)

	I	II	III	IV	V	VI	VII	VIII
P_2O_5	62	67	71	67	67	67	67	70
CaO	19	16	16	8.2	5.9	3.9	..	..
BaO	12	10	10	17.8	20.1	22.1	26	23
Al_2O_3	4	4	..	4	4	4	4	4
CoO	2	2	2	2	2	2	2	2
NiO	1	1	1	1	1	1	1	1
Per cent trans at 254 mμ..	33	49	63	65	70	63	51	41
Mol per cent ratio P_2O_5/-RO	1.05	1.34	1.42	1.80	2.00	2.20	2.78	3.28

Patent No. 2,397,195 was assigned to Libbey-Owens-Ford Glass Company by the inventors, Glenn C. Mook and Richard W. Ricker. It has been usual to employ some form of iron oxide in glass to absorb heat. If ferrous oxide was used, it gave the glass a bluish tint. Ferric oxide produced a yellowish tint both of which were objectionable. These inventors have discovered that if a halogen, such as chlorine or fluorine, is added to a soda-lime-silica batch, together with iron oxide, an improved heat absorbing glass will be produced. While it is preferred to use both chlorine and fluorine in the batch either one may be used alone.

The following table gives four examples of batch compositions within the scope of the patent.

Batch compositions

	Batch			
	A	B	C	D
Sand	1,000	1,000	1,000	1,000
Limestone	318	318	300	280
Soda ash	276	249	276	260
Salt cake	50	50	50	50
Salt (sodium chloride)...	....	30	....	30
Borax	20	20	20	20
Fluorspar (Calcium fluoride)	....	....	15	30
Iron scale	9.54	9.54	9.54	8.00
Powdered charcoal	5	5	5	5
Per cent Fe_2O_3 in finished glass	.75	.75	.75	.62

The transmission measurements of these four examples were made by a special apparatus described as follows:

1. The source of radiation for the three types of measurements consisted of a Monoplane projection lamp operated at a color temperature of 2848° K ± 20°.

2. The visible transmission of the glass specimen was measured with a photronic cell equipped with a Viscor filter.

3. The total radiation (total heat) transmission was measured by using a thermocouple receiver and a polished Jena glass filter, BG17, 2.5 mm. thick.

4. The infra-red transmission was measured by using the thermocouple received and a polished Corning Sextant red glass, No. 255, 3.5 mm. thick.

The transmission measurements obtained were:

	A	B	C	D	
Thickness of glass tested inches	⅛	⅛	⅛	⅛	¼
Transmissions:					
Visible	79.8	79.0	77.0	76.5	64.5
Total radiation	56.6	54.0	49.0	47.1	29.6
Infra-red	37.1	34.8	28.9	24.9	8.1
"Efficiency ratio"= Visibile / Total radiation.....	1.41	1.46	1.57	1.62	2.18

EXECUTIVE STAFF CHANGES AT CORNING

The Corning Glass Works has recently announced changes in its executive staff. New appointments have been brought about by the company's expanding interests.

William C. Decker, formerly Vice President, has been elected President. Mr. Decker succeeds Glen W. Cole, who has been made Vice Chairman of the Board of Directors. Charles D. LaFollette was named Treasurer and will continue in his present position as Vice President and Director of Sales. Eugene W. Ritter, Vice President, was added to the Board as were Messrs. Decker and LaFollette. John L. Ward, formerly Treasurer, was made Manager of the Bulb and Tubing Division of the company.

Dr. Eugene C. Sullivan, formerly Vice Chairman of the Board and Director of Research, was elected Honorary Vice Chairman, and Dr. Jesse T. Littleton was appointed Director of Research.

In recognition of the company's diversity of operations, according to the announcement, the Directors named an Executive Committee of seven all of whom are active operating officials as well as Directors. Amory Houghton will serve as Chairman of the Committee. Other members are Dr. Sullivan, George D. Macbeth, and Messrs. Cole, Decker, LaFollette and Ritter. William H. Curtiss will serve as Secretary of the Committee.

The complete list of officers and directors of Corning Glass Works is as follows: *Board of Directors:* Chairman, Amory Houghton; Vice Chairman, Glen W. Cole; William H. Curtiss, William C. Decker, Alexander D. Falck, Arthur A. Houghton, Jr., Charles D. LaFollette, George D. Macbeth, George Murnane, Gordon S. Rentschler, Eugene W. Ritter, Halsey Sayles and Eugene C. Sullivan.

Officers: Amory Houghton, Chairman of Board; Glen W. Cole, Vice Chairman of Board; William C. Decker, President; George D. Macbeth, Vice President and Controller; William H. Curtiss, Vice President and Secretary; Charles D. LaFollette, Vice President and Treasurer; Vice Presidents, Eugene W. Ritter, Harry M. Hosier, Jesse T. Littleton and William C. Taylor; Charles H. R. Young, Assistant Secretary and Treasurer; Assistant Secretaries, William W. Sinclaire and Frederick H. Knight.

Honorary Officers: Alexander D. Falck, Honorary Chairman of Board; Eugene C. Sullivan, Honorary Vice Chairman of Board; and Arthur L. Day and George B. Hollister, Honorary Vice Presidents.

NATIONAL AIROIL BURNERS

for FUEL OIL . . . for GAS

DOING ONE THING WELL

Throughout 34 years spent in the design and production of Oil and Gas Burners for all types of industries . . . including many Glass and Ceramic plants, we have faced and solved numerous combustion problems.

The accumulated experience of years may be of help in the solution of your problems . . . our engineering consultation is available.

Write us for further information.

NATIONAL AIROIL BURNER COMPANY, INCORPORATED
1255 East Sedgley Avenue
PHILADELPHIA 34, PENNA.
Texas office: 2nd National Bank Bldg., Houston
ESTABLISHED 1912 INCORPORATED 1917

A NEW MODEL
POLAROID*
Glass inspection polariscope

Polarizing field is of 6" diameter. The analyzing eyepiece is located 14" from the polarizer. The eyepiece is a rectangle 3¼" x 1" with a facility of vision far greater than any unit made previously by us. It can be swung to any position from the vertical to the horizontal.

Send for descriptive bulletin

THE POLARIZING INSTRUMENT CO., INC.
41 EAST 42nd STREET NEW YORK CITY, 17
*T.M. Reg. U.S. Pat. Off.

HOMMEL
COLORS AND CHEMICALS
"The Industry's Finest"

COLORS • Transparent and Opaque Enamels, Fluxes, Liquid Lustre Colors, Irox, Burnish Gold and Silver, Paste Gold, Stamping Gold, Liquid Gold.
ALKALI RESISTANT COLORS for spraying and squeegee—Milk and Beverage Bottles, Tumblers and Cosmetic Jars.
ACID RESISTANT COLORS — Tableware and Laboratory Ware.
SULFIDE RESISTANT COLORS—Tableware, Illuminating Ware and Cosmetic Jars.

CHEMICALS AND MATERIALS

Acids	Cryolite (natural)	Selenium
Ammonium Bifluoride	Feldspar	Soda Ash
Arsenic	Fluoride	Sodium Antimonate
Barium Carbonate	Fluorspar	Sodium Bichromate
Bone Ash	Iron Chromate	Sodium Nitrate
Borax	Potassium Bichromate	Sodium Silico Fluoride
Cadmium Sulphide	Potassium Carbonate	Sodium Uranates
Boric Acid	Salt Cake	Sulphur
Clays		Zirconium Silicate

OXIDES

Chrome Green Oxide	Manganese Dioxide	Uranium Oxide
Cobalt Oxide	Nickel Oxide	Zinc Oxide
Copper Oxide	Tin Oxide	Zirconium Oxide
Iron Oxides	Titanium Dioxide	

Phone Walnut 1198

O. HOMMEL CO.
PITTSBURGH 30, PENNA.
Pacific Coast Agents
L. H. BUTCHER CO.

World's Most Complete Ceramic Supplier

BORAX and BORIC ACID
99½-100% Pure

CAUSTIC SODA
NITRATE OF POTASH SULPHUR

OTHER STAUFFER PRODUCTS

*Aluminum Sulphate	Cream of Tartar	Sulphuric Acid
Borax	Chlorine	Sulphur Chloride
Boric Acid	Muriatic Acid	*Superphosphate
Carbon Bisulphide	Nitric Acid	Tartar Emetic
Carbon Tetrachloride	Silicon Tetrachloride	Tartaric Acid
Citric Acid	Sodium Hydrosulphide	Titanium Tetrachloride
*Copperas	Stripper, Textile	

(*Items marked with star are sold on West Coast only.)

Stauffer CHEMICAL
SINCE 1885

STAUFFER CHEMICAL CO.
420 Lexington Avenue, New York 17, N. Y.
221 North LaSalle Street, Chicago 1, Illinois
636 California Street, San Francisco 8, Cal.
North Portland, Oregon Houston 2, Texas

DEPARTMENT OF JUSTICE FILES SUIT AGAINST O-I—GLASS COMPANY ISSUES COMMENT

According to a recent release issued by the Department of Justice, a civil action charging Owens-Illinois Glass Company with violation of the antitrust laws has been filed in the United States District Court in San Francisco. Commenting on the case, Attorney General Tom C. Clark, said, "This action is another step in our drive to free the container industry from restrictive and monopolistic practices."

The complaint alleges that Owens-Illinois manufactures more than 75 per cent of the machinery employed for vacuum-packing in glass containers. It claims that Owens-Illinois does not sell these machines, but under letters patent, leases them to packers upon the condition that they use only glass containers and closures manufactured by Owens-Illinois. It further claims that the penalty for buying and using glass containers and closures sold by competitors of Owens-Illinois is cancellation of the lease and recapture of the leased machinery.

Attorney General Clark described the effect of Owens-Illinois' practices as creating a monopoly in the glass container and closure business and preventing those packers leasing machinery from Owens-Illinois from buying glass containers and closures from others at prices and on terms set by free and open competition. Wendell Berge, Assistant Attorney General, Chief of the Antitrust Division stated:

"The glass container industry has suffered from the practice of the defendant. Vacuum-packers leasing defendant's machines have also been at its mercy by reason of the compulsion upon them to use glass containers and closures by defendant's manufacture regardless of price or quality. The West Coast particularly has felt the effect of defendant's wrongdoing because of its prominence in the vacuum packing field. Glass containers are used primarily for the packing of coffee and more than half of the domestic vacuum-packing of coffee is done on the West Coast."

The suit asks the court to declare that Owens-Illinois has violated the antitrust laws, that its leases termed as "tie-in" are unlawful and void, and that it has monopolized the glass container and closure business. The suit also seeks an injunction against future "tie-in" leases and against infringement suits by Owens-Illinois on any patents which it has employed to effect such alleged illegal leases.

The Government's case was prepared by James McI. Henderson, Julian Caplan, Stephen D. Maffini and Lawrence M. Somerville, all of the San Francisco office of the Department of Justice.

Owens-Illinois in commenting on the action states as follows:

"Owens-Illinois was the first glass company to investigate and apply the principle of vacuum sealing to glass coffee containers. Previously, vacuum packaging had been confined to metal containers. After years of experimentation by Owens-Illinois scientists in the Company's Packaging Research and Planning Division Laboratories, closing machines for vacuum packing with glass were developed. Many obstacles and problems had to be overcome

(*Continued on following page*)

CLASSIFIED ADVERTISEMENTS

POSITION WANTED
EXECUTIVE OR EXECUTIVE ASSISTANT
PRODUCTION OR SALES ADMINISTRATION

Extensive, diversified experience in the glass industry since 1934; management, production, sales and development. Established and was Chief of Glass Unit in government during war. Position desired where such experience could prove an invaluable asset to a progressive concern. Age 35, married, two children. Available June 1. Location unimportant. Reply Box 43, c/o The Glass Industry, 55 West 42nd Street, New York 18, N. Y.

GLASS ENGINEER AVAILABLE

Returned veteran, glass engineer, experience, B.S. in Glass Tech., N. Y. State College of Ceramics 1942, seeks position with future, immediate salary secondary, preferably in research or development of lamps or vacuum tubes. Reply Box 40, c/o The Glass Industry, 55 West 42nd Street, New York 18, New York.

HELP WANTED

MOLD DESIGN ENGINEER with mechanical engineering degree or equivalent in experience and training. At least five years in glass business, two years of which on mold design or glass forming and some supervisory experience. Hartford-Empire Company, Drawer 1620, Hartford, Conn.

FACTORY AND USED EQUIPMENT WANTED

Will buy a factory building of about 30,000 square feet with additional land suitable for a glass plant, preferably with a R.R. siding. Wanted also used glass plant equipment such as lehrs, batch mixer, cullet mashing machine, blowers, etc. Reply Box 42 c/o The Glass Industry, 55 West 42nd Street, New York 18, N. Y.

WANTED TO BUY: Press, hand operated or automatic for 14 inch diam. bowls. Reply Box 41, c/o The Glass Industry, 55 West 42nd Street, New York 18, New York.

DEPT. OF JUSTICE FILES SUIT AGAINST O-I . . .

(*Continued from preceding page*)

and substantial expenses were incurred before machines were available for commercial use.

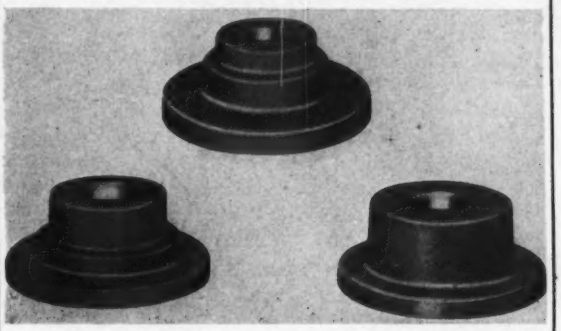
"The vacuum closing machines were leased at a purely nominal rental in order to encourage coffee roasters to shift to glass containers. Owens-Illinois also furnished expert maintenance men to install and keep the equipment in order, so that Owens-Illinois could recoup its developmental expenses. Some of the early leases provided that only Owens-Illinois glass containers and closures could be used with the machines.

"The early Owens-Illinois leases were similar to the gasoline pump leases common in the oil industry. The United States Supreme Court has held that these gasoline pump leases do not violate the anti-trust laws.

"After Owens-Illinois had pioneered the field, other glass companies and equipment manufacturers developed similar vacuum closing machines which are available to coffee roasters and are in free and direct competition with Owens-Illinois.

"In the light of war-time conditions, Owens-Illinois a year ago removed all limitations in its leases so that coffee roasters may use glass containers and closures of any manufacture with Owens-Illinois machines."

Gunite's Standard Grade A
for
Guide Rings

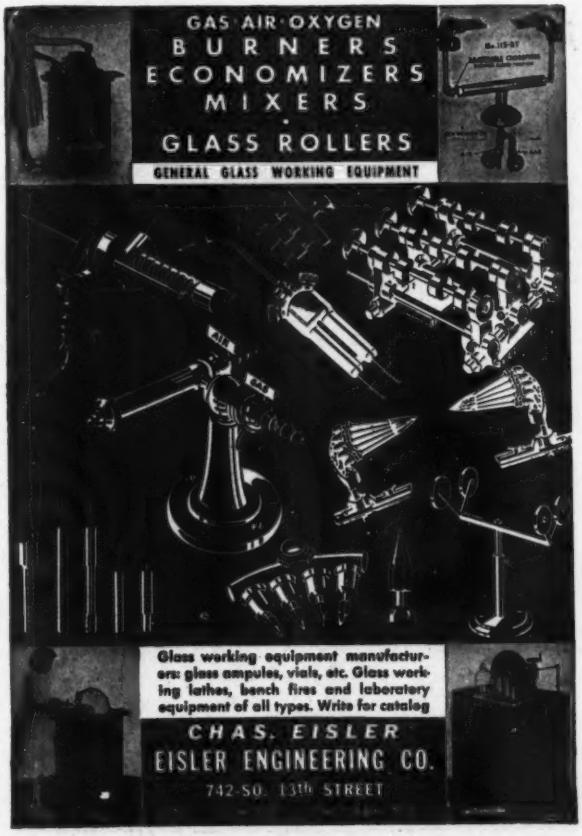


Like all Gunite glasshouse castings Standard grade A is used for guide rings because it is best adapted to this particular purpose.

There is a suitable Gunite Alloy for every type of glass making part, including Plungers, Guide Rings, Neck Ring Sticks, as well as Round Bar Stock.

Send for descriptive bulletin

GUNITE
FOUNDRIES CORPORATION
ROCKFORD ILLINOIS


GAS AIR·OXYGEN
BURNERS
ECONOMIZERS
MIXERS
GLASS ROLLERS
GENERAL GLASS WORKING EQUIPMENT
Glass working equipment manufacturers: glass ampules, vials, etc. Glass working lathes, bench fires and laboratory equipment of all types. Write for catalog
CHAS. EISLER
EISLER ENGINEERING CO.
742-50 13th STREET